Advant® OCS
with Master software

MasterFieldbus™ and S400 I/O

User’s Guide

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Prefix A Introduction to this Manual

A.1 About this manual

This manual consists of two logical parts:

- The first part (chapter 1 - 6) concerns the ABB MasterFieldbus. This manual covers the use of MasterFieldbus in the MasterPiece 200/1 Series and Advant Controller 400 Series products.
- The second part (chapter 7 - 13) concerns the S400 I/O units (in this manual named “the I/O units”) and MasterPiece 51 (MP51), which can be connected to the ABB MasterFieldbus.

This edition of the manual replaces all previous editions.

The MasterPiece 200/1 and Advant Controller 400 Series products are called Controllers in this manual. Operator interface products, i.e. MasterView 800 Series and Advant Station 500 Series, are called Operator Station (OS). MasterAid 220, AdvantStation 100 and compatible options in workstation based products are called Configuration Tools or simply Tools.

A.2 Reference literature

For further information concerning the products and functions which are mentioned herein but not described in detail in this document may be obtained from other product documentation.

Chapter 1 Introduction to MasterFieldbus

1.1 General

ABB MasterFieldbus is a communications link for ABB Master Process Stations, which makes it possible to communicate with subordinated units to sites near the controlled process. MasterFieldbus allows serial communication over distances up to 750 meter (2,460 ft.).

Physically, ABB MasterFieldbus consists of a controller which is mounted in a rack, a short-distance bus (SDB[1]) consisting of a shielded two-wire cable, a long-distance bus (LDB[1]) consisting of a coaxial cable, modems and terminating units. The necessary software comes as standard with the Process Station.

1.2 Overview of ABB MasterFieldbus

The first link of ABB MasterFieldbus following the serial bus controller in the Controller is always a short-distance bus (the primary SDB), whose maximum length is 25 meter (82 ft.). Both remote I/O units and modems for long-distance buses can be connected to this short-distance bus. Only modems can be connected to the long-distance buses, and the secondary short-distance buses to which only the remote I/O units can be connected are connected to these modems. The bus network cannot undergo further branching from a secondary short-distance bus.

Consequently, a remote unit can be connected to the Controller in two ways. See Figure 1-1 and Figure 1-2.

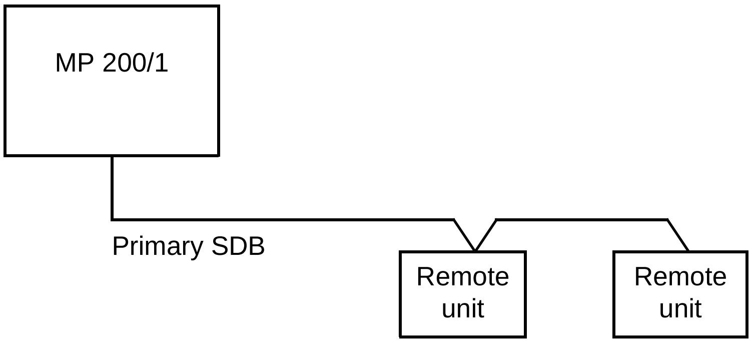

Figure 1-1. Remote I/O Units, connected directly to the Primary SDB from DSCS 130/131

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[1] SDB is an abbreviation for Short Distance Bus and LDB is an abbreviation for Long Distance Bus

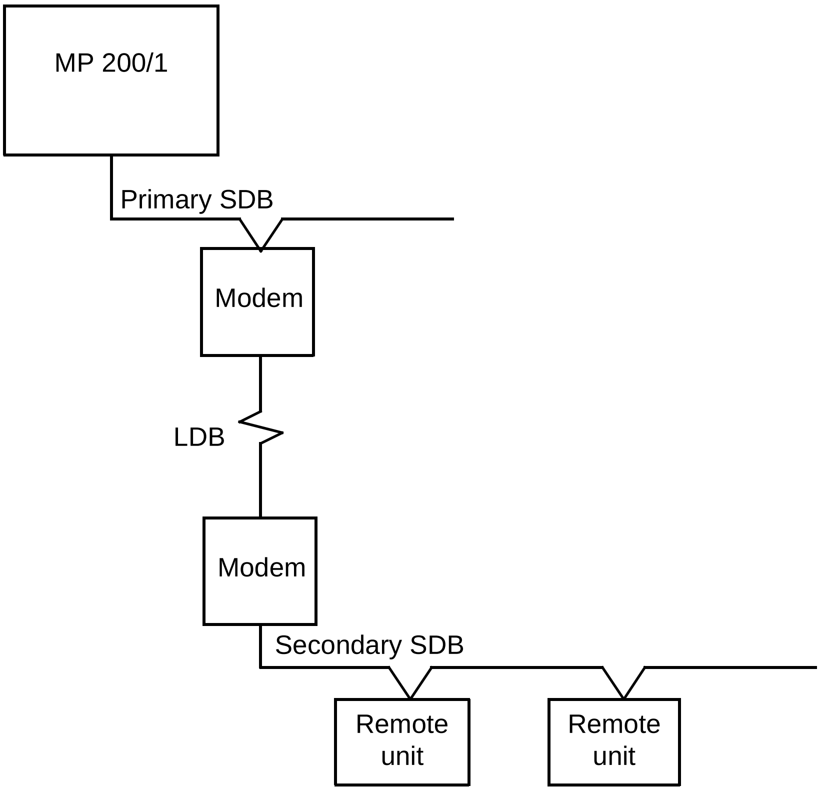


Figure 1-2. Remote I/O Units, connected to DSCS 130/131 via Primary SDB - modem - LDB - modem - Secondary SDB

The two connecting methods can be combined in many ways, but the following limitations apply:

- up to 16 remote I/O units can be connected to one bus controller
- up to 10 modems can be connetected to an LDB
- two LDB’s cannot be connected in series with intermediate SDB’s.

Redundancy can be introduced into a MasterFieldbus configuration by the addition of a second similar bus.The two primary short distance busses, up to a maximum length of 25 meters (82 ft.), designated SDB_A and SDB_B then connect the serial bus controller to distributed units and modems. The serial bus controller polls the distributed units at regular intervals via either
SDB-A or SDB-B and updates the information in a double port memory on the serial bus controller.

The distributed units are connected via a multiplexer. The multiplexer connects the incoming signals transmitted via SDB-A or SDB-B to the distributed units via the short distance bus SDB-C. The answer from the distributed unit is transmitted via the multiplexer over the recently active

SDB-A or SDB-B to the serial bus controller. Figure 1-3 shows the topology of a configuration with a redundant bus.

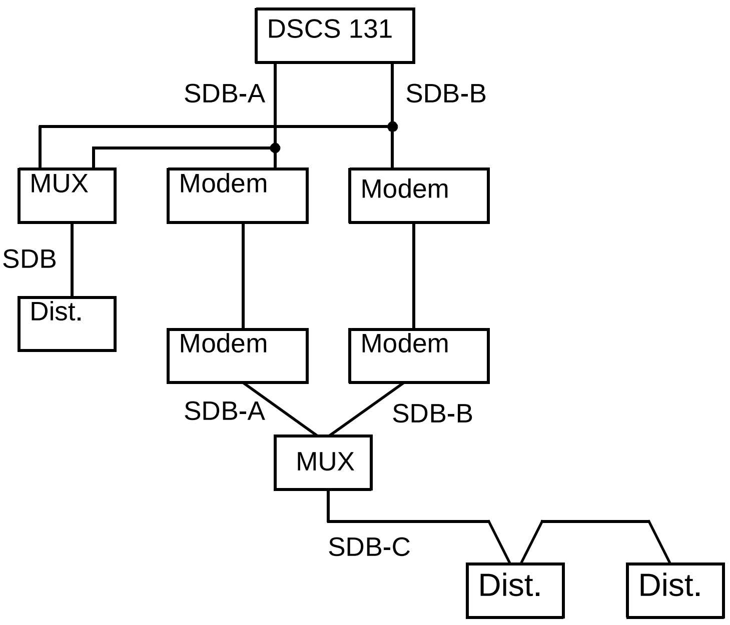


Figure 1-3. Topology MasterFieldbus with Redundant Media

There are considerable possibilities of building up a system within the limitations shown above. Figure 1-4 shows an example of a configuration and Figure 1-5 shows a similar configuration with a redundant bus.

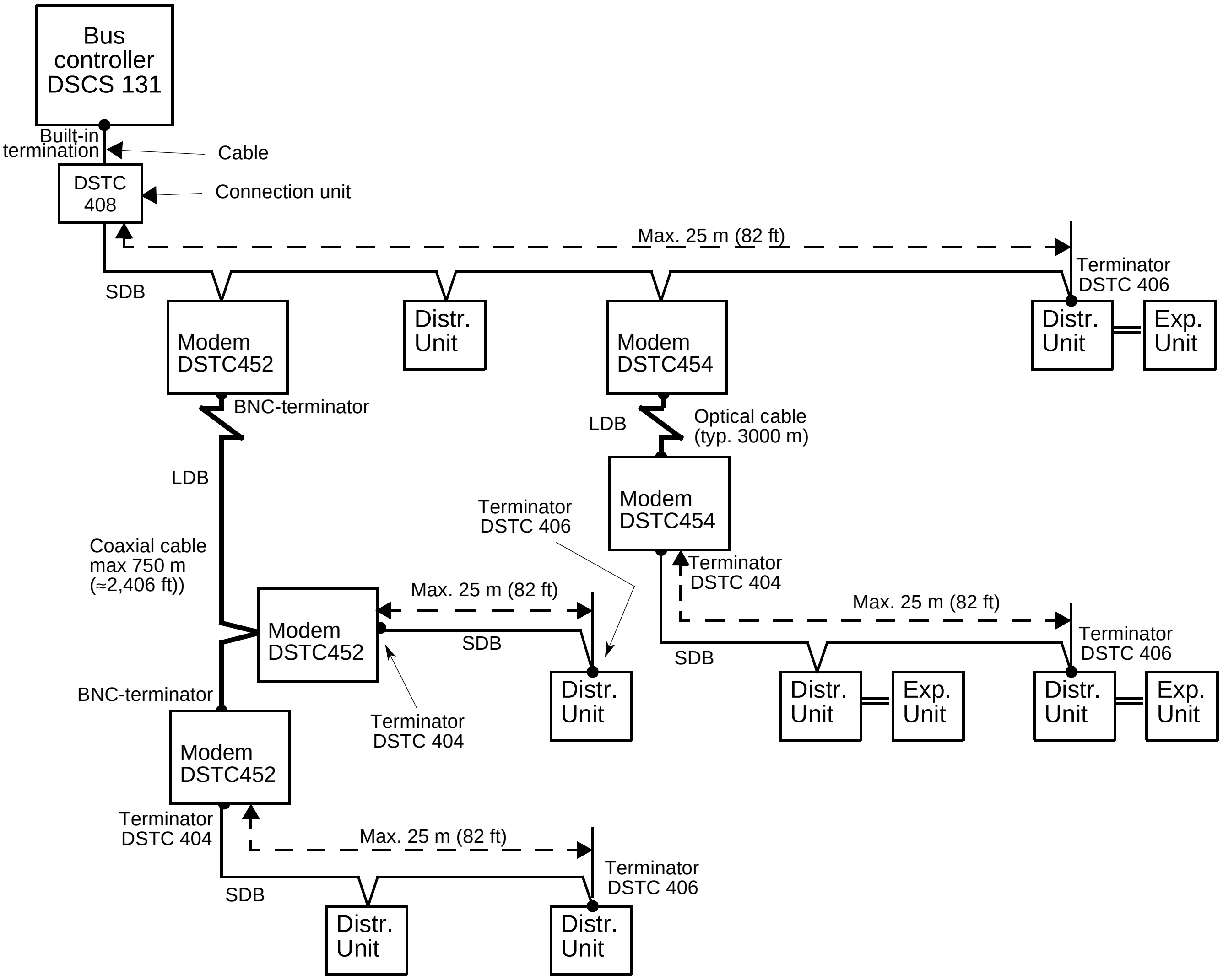


Figure 1-4. Example of Physical Configuration of ABB MasterFieldbus and Remote I/O Units

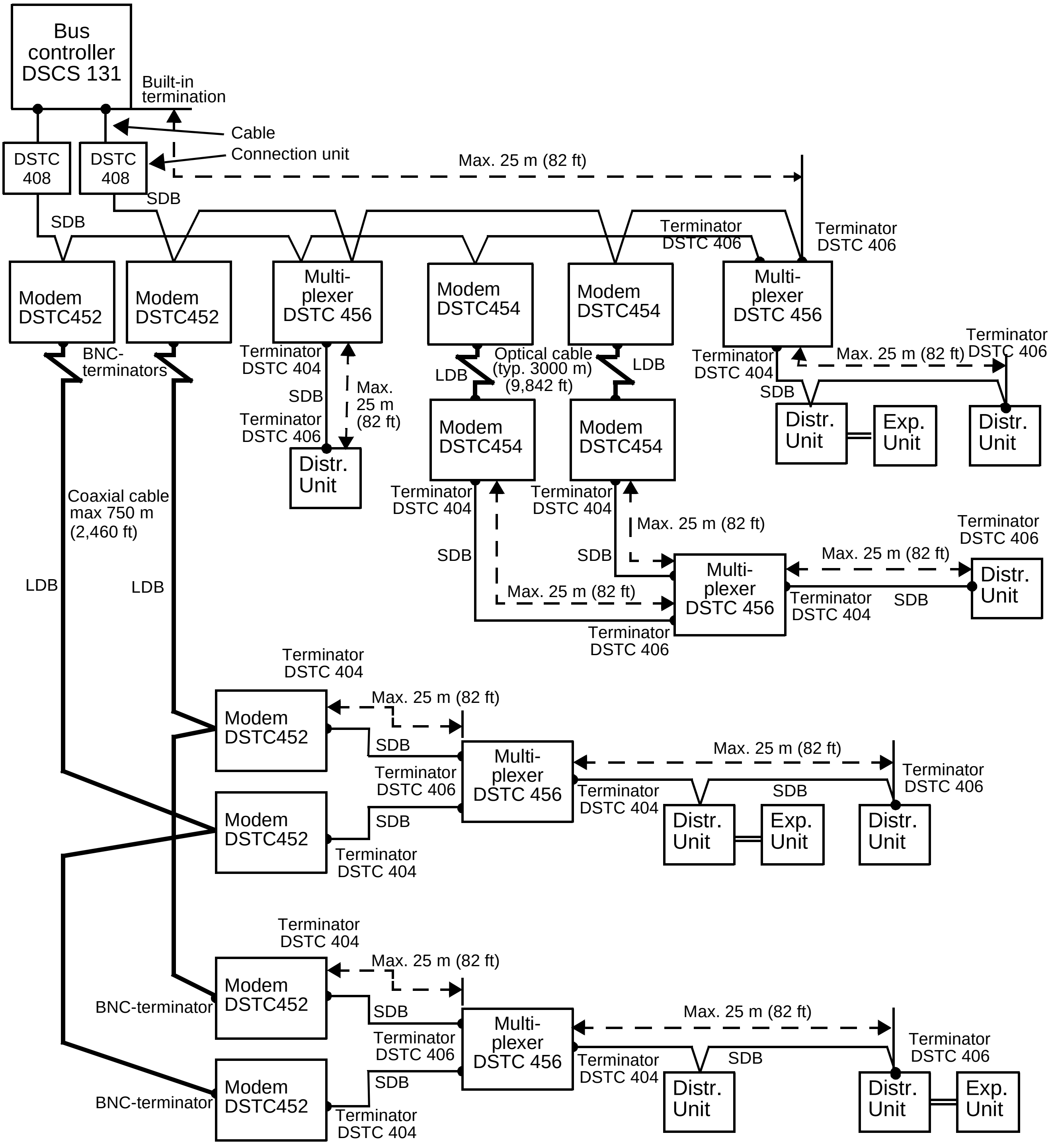


Figure 1-5. Example of Physical Configuration on of Redundant ABB MasterFieldbus and Distributed Units

Chapter 2 Technical Description of MasterFieldbus

2.1 Bus Controllers

2.1.1 Bus Controller DSCS 130

Serial bus controller DSCS 130 is used with the Controller and is a plug-in board which is placed in the Controller's main frame, i.e., in the frame which contains the processor and memory boards (the CPU subrack). A maximum of four bus controllers can be installed in the Controller.

There are two connectors, X1 and X2 located on the rear edge of the board. X1 connects to the rack's parallel bus (at the rear) while X2 connects to the short-distance bus (SDB) inside the MasterFieldbus via connecting cable DSTK 127 and connection unit DSTC 408.

The board has strap groups, used for setting the address and the communication speed (see Section 4.1 General).

The board's front panel includes a red LED error indicator and 16 yellow LEDs which indicate the MasterFieldbus nodes with which contact has been made by the bus control board.

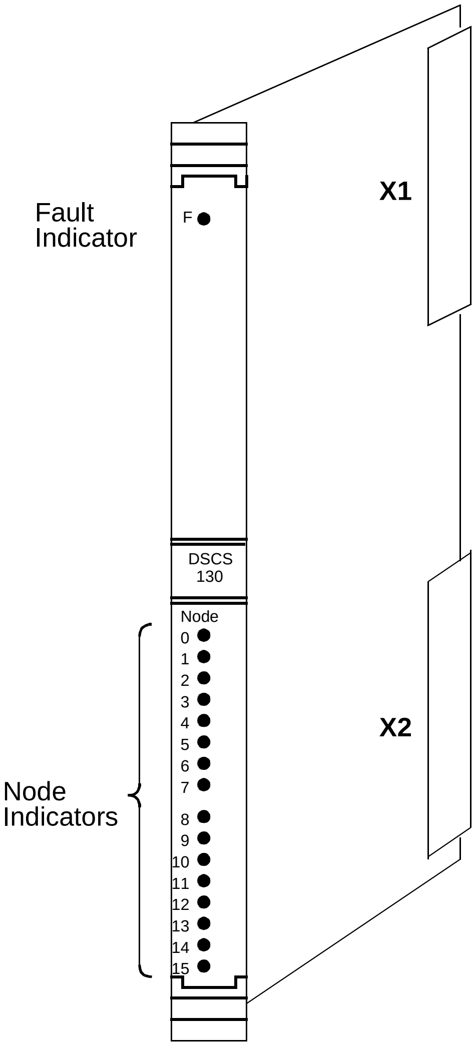


Figure 2-1. Bus Controller DSCS 130

2.1.2 Bus Controller DSCS 131

The serial bus controller DSCS 131 is a further development of DSCS 130, that can handle redundant physical media.

Two connectors, X1 and X2, are located at the rear edge of the board. X1 is connected to the parallel bus of the subrack (back plane) and X2 is connected to two short distance busses designated SDB-A and SDB-B respectively, one per redundant physical medium, via the connection cable DSTK 132L2.5 and two connection units DSTC 408. With the connection cable DSTK 127, the board operates exactly as DSCS 130.

The board has jumper for the setting addresses and communication speed (see Section 4.1 General). The following LEDs are located on the front panel of the board. One red LED for indication of malfunction, two yellow LEDs for indication of the active medium and 16 yellow LEDs which indicate the nodes on the MasterFieldbus with which the serial bus controller board can communicate with.

DSCS 131 is normally installed in the CPU subrack but can as well be installed in any I/O rack, for example if the CPU rack is full. This requires the straps of the strapping group S2 of the DSCS 131 to be set to 0 instead off 1 and also the strap S1:7 on the same board to be set to 0.

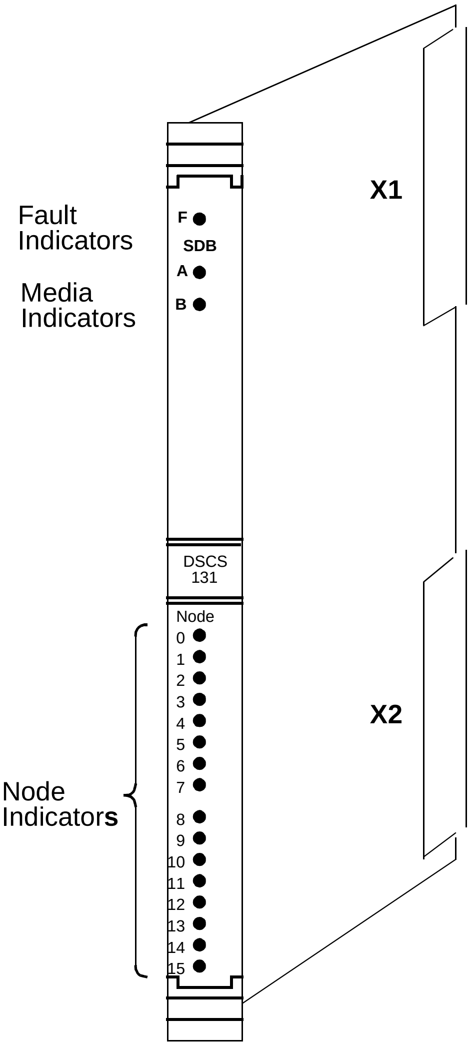


Figure 2-2. Bus Controller DSCS 131

2.1.3 Bus Controller CI570

The CI570 is a bus controller version used in the Advant Controller 400 Series of Controllers. CI570 is functionally compatible to the DSDC 131 bus controller. CI570 is capable of handling redundant physical media.

CI570 is a sub-module, which in AdvantController 450 shall be used together with a carrier device, for example SC510. In AdvantController 410 it fits directly in one of the slots in the CPU front. For additional information see manual for the actual Controller.

The module has one connector in the rear edge, which fits into the sub-module slots. The front of the module has one connector for connection of the short distance buses, SDB-A and SDB-B, to the connection unit TC570. This is done using the prefabricated cable TK570. TK570 is available in different length to fit different installation alternatives.

CI570 has no user operable straps or switches. All user selectable functions, such as communication speed, single or cable redundant operation, are configured on the data base element. See appropriate DB-element user’s manual.

The following LEDs are located at the front of the module. One red LED (“F”) for indication of malfunction, one green LED (“RUN”) for indication of proper operation, i.e. that the module is properly running the bus. In addition there are two yellow LEDs (“A” and “B”) indicating which media is currently used for data transfer (SDB-A or SDB-B). At single operation only the “A” LED is lit.

The connection unit TC570 has 16 yellow LEDs to indicate which nodes on the bus, the bus controller has established communication with.

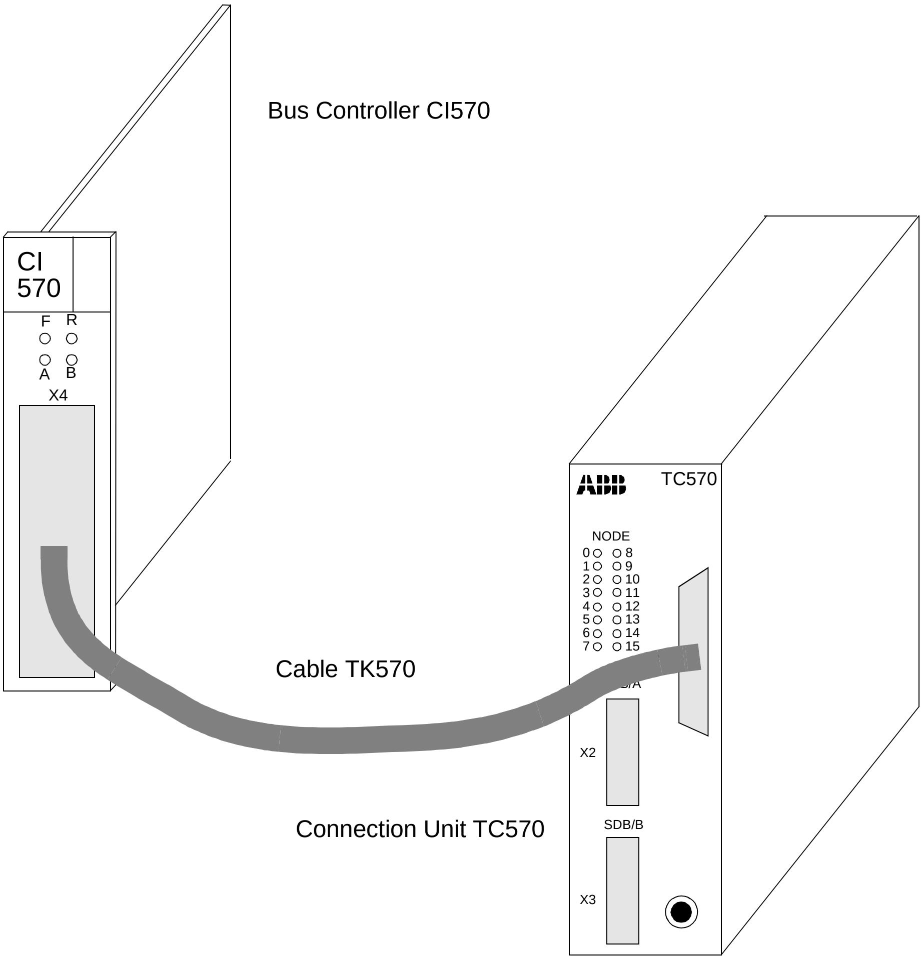


Figure 2-3. Bus Controller CI570

2.2 Modem and Multiplexer

2.2.1 Electrical modem DSTC 452

Modem DSTC 452 is used to extend the ABB MasterFieldbus up to 750 m (2,460 ft.) from the central unit.

Modem DSTC 452 is an enclosed unit which is intended to be mounted on a wall, a mounting plate or two parallel DIN rails.

The modem requires a separate power supply (110-130/220-240 V a.c.). The modem connects to the short-distance bus (SDB) via a plug-in terminal, and to the MasterFieldbus long-distance buses (LDB) via BNC coaxial connectors.

DSTC 452 has three LED status indicators:

P	Power supply
Rx	Modem is receiving signals from LDB and sending on SDB
Tx	Modem is receiving signals from SDB and sending on LDB

Inside the cover there is a mains fuse and a strap group for setting the communication speed.

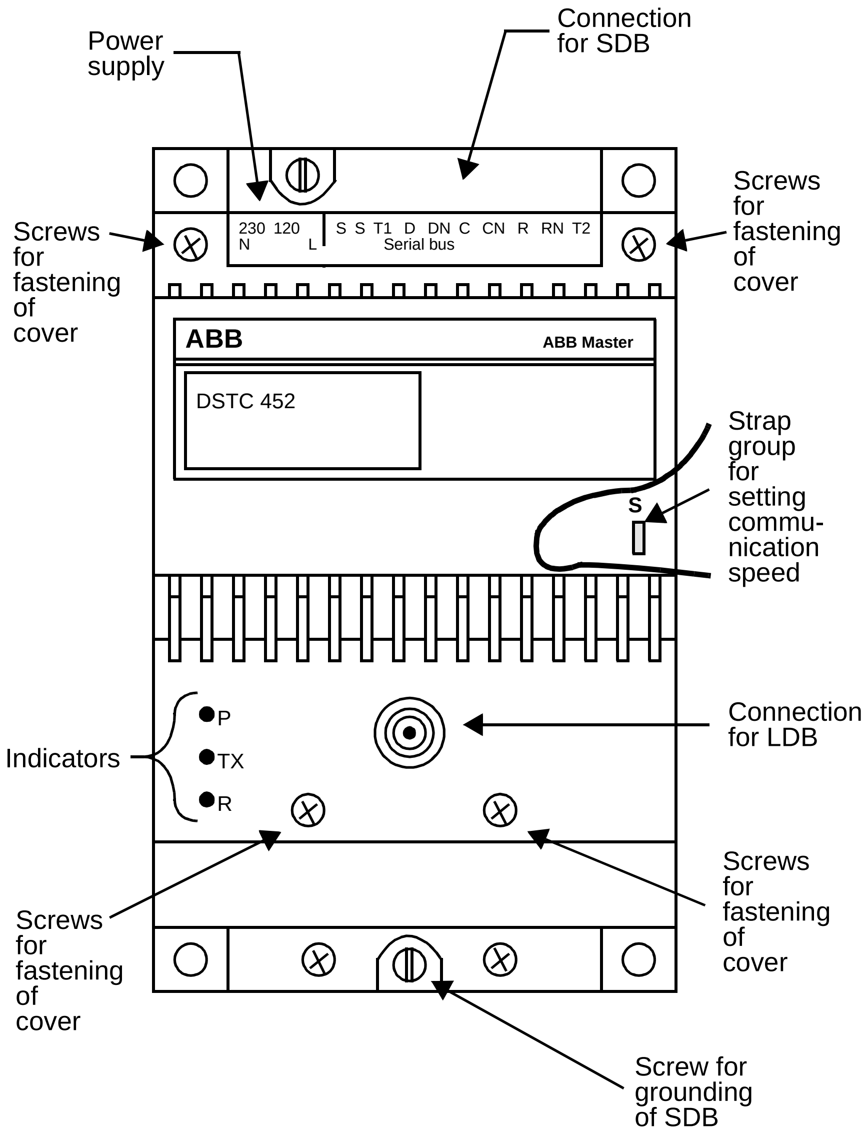

Power supply
Connection for SDB
Screws for fastening of cover
Screws for fastening of cover
230 120
N L
S S T1 D DN C CN R RN T2
Serial bus
ABB
ABB Master
DSTC 452
Strap group for setting commu-nication speed
S
P
TX
R
Indicators
Connection for LDB
Screws for fastening of cover
Screws for fastening of cover
Screw for grounding of SDB

Figure 2-4. Modem DSTC 452

2.2.2 Optical modem DSTC 454

The modem DSTC 454 is used to permit extension of the ABB MasterFieldbus with a fibre-optic cable to a typical length of 3000 m (9,842 ft.).

The maximum length is dependent on cable type, the number of splices etc. See Section 2.6 Power budget for optical LDB. The modem is used when a high degree of insulation and resistance to interference is required or when the transmission distance of the electrical long distance bus is insufficient.

The modem require separate power supply in the same way as DSTC 452.

DSTC 454 have the same physical form as DSTC 452 except for the connection of the LDB.

DSTC 454 also have three indicators with the same significations as on DSTC 452.

DSTC 454 can only be used with 2 Mbit/s and it is therefore not equipped with straps for setting the data transmission speed.

A version of DSTC 454, called DSTC 454L, which operates at 375 kbit/s is available. This modem has the same shape and function as DSTC 454.

The quantity of light energy introduced into the fiber varies with different fiber dimensions and different manufacturer. To ensure that the light energy received is not excessive, which can result in over-modulation of the receiver, a strap with which the output power can be set is provided (see Section 4.3.3 Strapping of optical output power).

Inside the cover you will find the main fuse and the strapping for the output power.

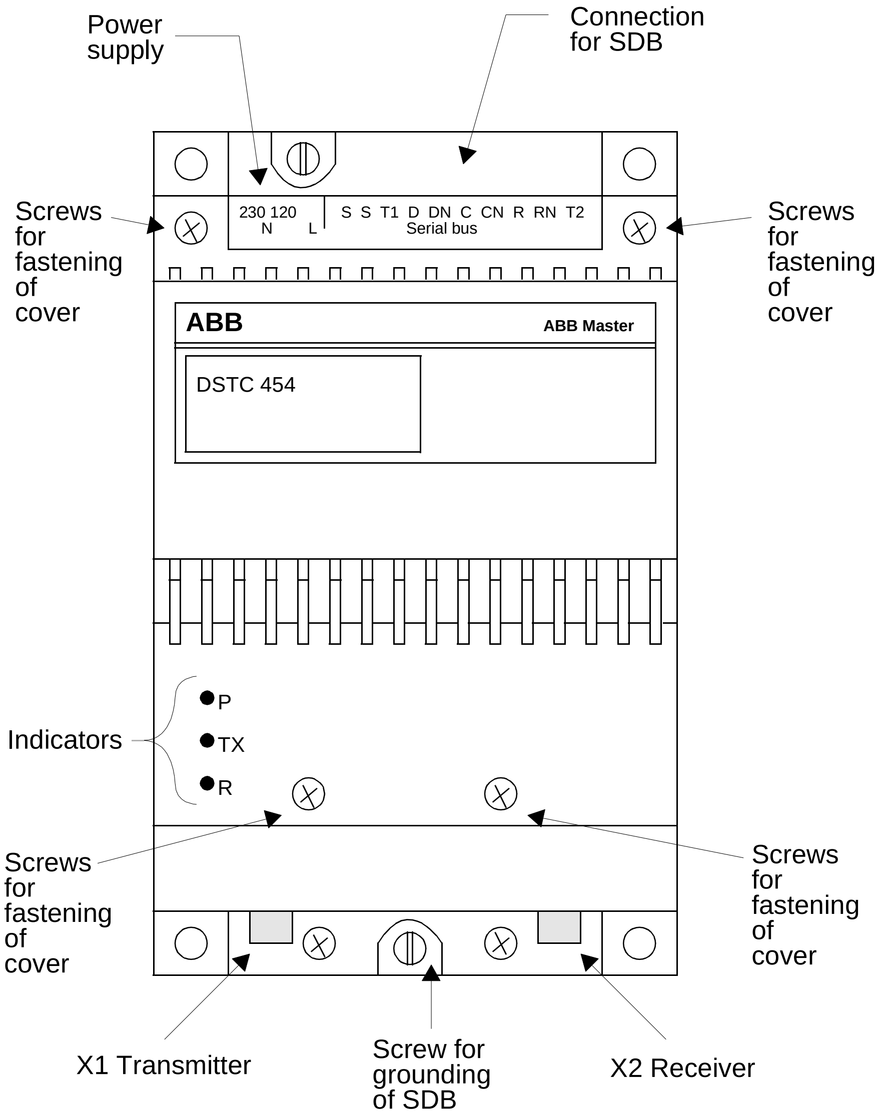

Power supply
Connection for SDB
Screws for fastening of cover
230 120
N L
S S T1 D DN C CN R RN T2
Serial bus
Screws for fastening of cover
ABB
ABB Master
DSTC 454
Indicators
P
TX
R
Screws for fastening of cover
Screws for fastening of cover
X1 Transmitter
Screw for grounding of SDB
X2 Receiver

Figure 2-5. Optical Modem DSTC 454

2.2.3 Multiplexer DSTC 456

The multiplexer DSTC 456 is used together with the bus controller to obtain redundant physical media for a MasterFieldbus.

The Multiplexer DSTC 456 is connected to two short distance busses (SDB-A and SDB-B) and connects these alternately to a third short distance bus (SDB-C).

The multiplexer is physically the same as the modems DSTC 452 and DSTC 454 and is installed in the same way. (see Section 3.7 Modem Installation).

The multiplexer requires separate 110-130/220-240 V power supply. Connections are made via pluggable terminals to the power supply and to the short distance busses.

DSTC 456 is provided with three LEDs for indication of its status.

P	(green) Supply
R_X	(yellow) Data is transmitted from the slave to the master (i.e data is received at X12)
T_X	(yellow) Data is transmitted from the master to the slave (i.e. data is received at X1 or X2).

A mains fuse and a jumper for setting the speed of communication are located under the cover.

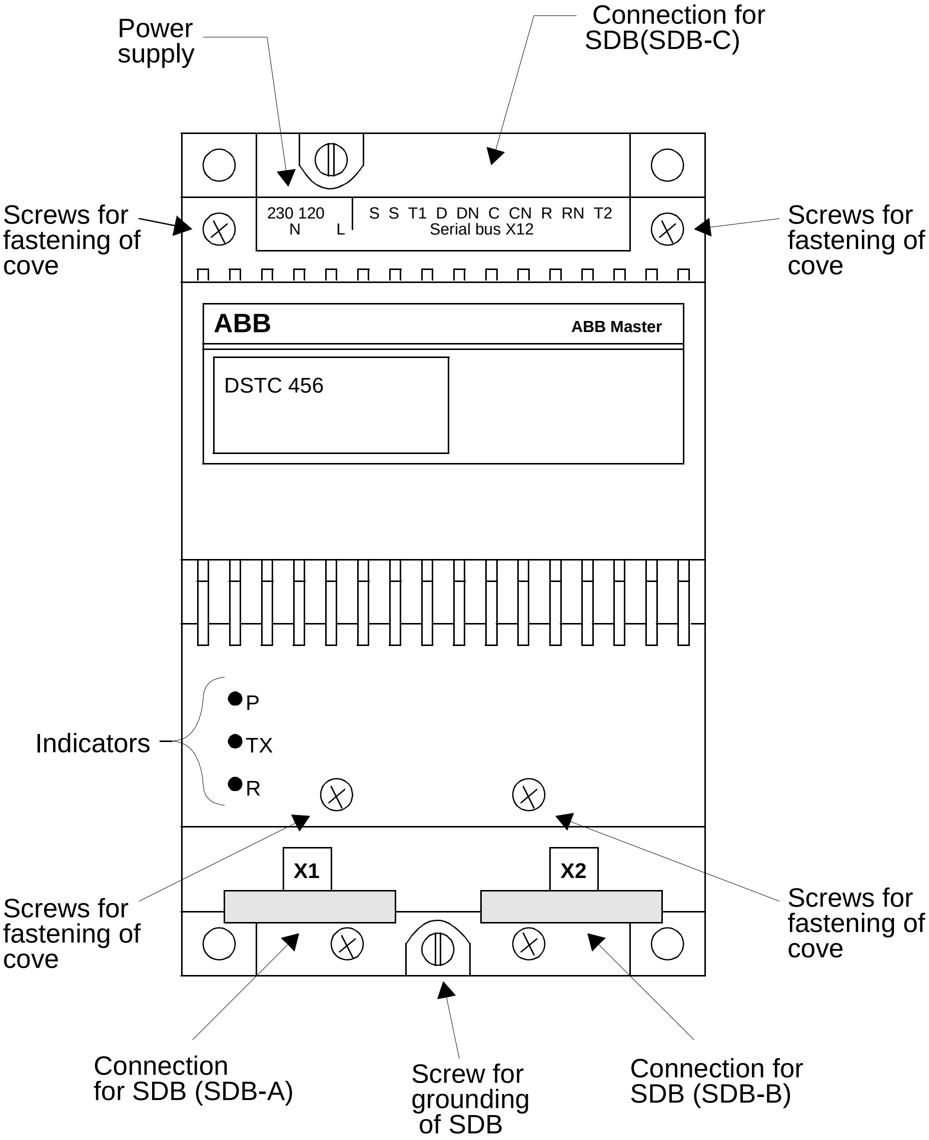

Power supply
Connection for SDB(SDB-C)
Screws for fastening of cove
230 120
N L
S S T1 D DN C CN R RN T2
Serial bus X12
Screws for fastening of cove
ABB
ABB Master
DSTC 456
Indicators
P
TX
R
X1
X2
Screws for fastening of cove
Screws for fastening of cove
Connection for SDB (SDB-A)
Screw for grounding of SDB
Connection for SDB (SDB-B)

Figure 2-6. Multiplexer DSTC 456

2.3 Short-distance bus, SDB

The short-distance bus, SDB, consists of a shielded cable with individually twisted pairs to suppress interference. The SDB provides no galvanic insulation of the connected units and has a limited tolerance to CMV (Common Mode Voltage) of ±7 V. The maximum length is 25 m (82 ft.).

One primary SDB leads from the bus controller in the Controller at all times. Up to 16 remote I/O units or modems may be connected to the primary SDB.

Up to 16 remote I/O units can be connected to a secondary SDB, which leads from a modem; however, no additional modems may be connected to a secondary SDB.

SDB’s are connected to modems and remote I/O units via plug-in terminals.

One can replace a remote unit without disturbing any other communication in the system.

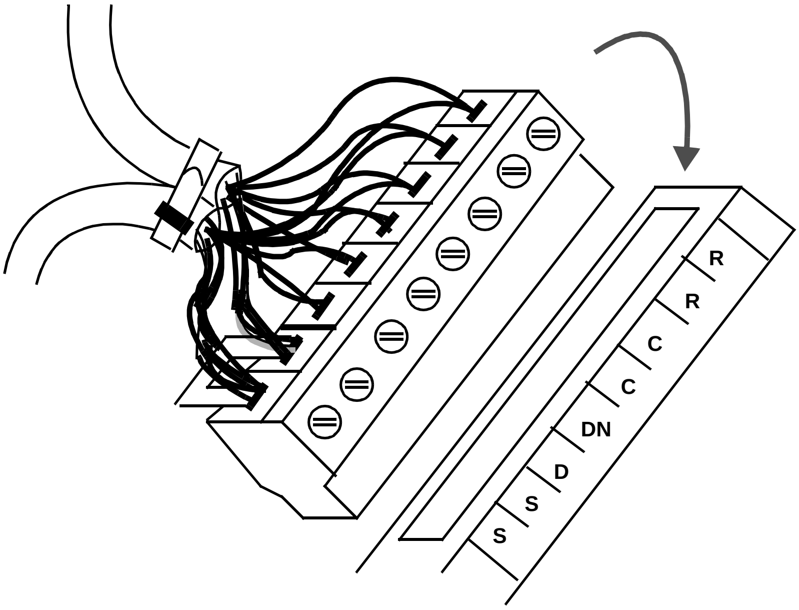


Figure 2-7. Cable for SDB, Connected to a Plug-In Terminal

2.4 Long-distance bus, LDB

2.4.1 Electrical Long Distance bus

The long-distance bus (LDB) consists of a coaxial cable which meets the requirements specified in Section 6.6 LDB Cable.

The LDB may be up to 750 m (2,460 ft.) in length (depending on the type of cable used).

Only modems (maximum of 10) can be connected directly to the LDB.

The LDB is galvanically insulated from the modem. The cable shielding is capacitively coupled to the modem’s chassis at each connection point. This normally provides sufficient interference suppression, assuming indoor installation.

However, the LDB shielding can also be grounded in cases of installation in countries whose safety regulations so require. In such cases the shielding is grounded at only one point.

The LDB is connected to a modem via a BNC-T connector. One can replace a modem without disturbing any other communication in the system. The LDB is terminated in the end modem by a 75 ohm BNC terminating plug.

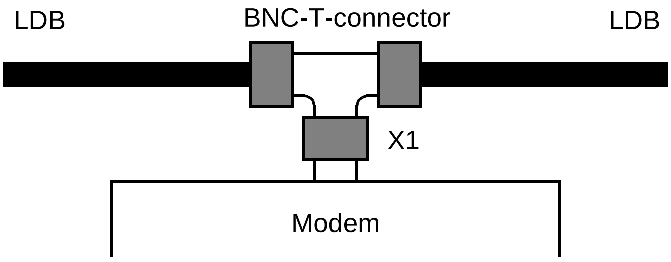


Figure 2-8. Coaxial Cable for LDB, with BNC-T Connector

2.4.2 Optical long distance bus

The optical long distance bus consists of a fibre cable with diameter 50-100 µm and is connected via optical connectors of type SMA.

The length of the bus is typically 3000 m (9,842 ft.) with a maximum of approximately 4500 m, depending on cable type etc. The maximum distance for a particular application can be calculated on the basis of the content of Section 2.6 Power budget for optical LDB.

The optical LDB establishes **point-to-point** connection between two modems with the help of one fiber cable in each direction.

2.5 Communications protocol

The communications protocol for the ABB MasterFieldbus is a subset of the standard protocol ISO-HDLC. This means that the serial bus controller cyclically polls the nodes, i.e., the remote I/O units, which respond in turn. If a remote unit fails to respond within a certain time period, the next unit is then polled. If a unit fails to respond to a number of consecutive pollings the bus controller will indicate that the unit is faulty. However, the node in question will continue to be polled during each program cycle and the fault indication will cease as soon as the unit responds again. This means that remote I/O units may be coupled in and out of the system without difficulty, and without disturbing the operation of the rest of the system; it also means that communication will begin automatically with a new unit which is connected at a node, provided that the unit has been configurated in the data base.

Using the higher communication speed (2 Mbit/s) and assuming that all of the digital channels (16 x (32 + 32) = 1,024) are in use, all of the units are polled in a maximum cycle time of 10 ms. The time required to perform a polling cycle will decrease if fewer nodes are coupled in, but it will increase if analog remote I/O units are coupled in.

Maximum cycle time at high speed (2 Mbit/s):	17 ms
Maximum cycle time at low speed (375 kbit/s):	51 ms

The security of the transmitted data is well within the IEC Technical Committee proposed guidelines (#57) regarding cyclically updated data (class 1). In an environment with heavy interference the requirements for event-controlled communication (class 2) are satisfied. In practice this means that the average interval between undetected errors can be expected to exceed 1,000 years.

2.6 Power budget for optical LDB

For reliable communication, it is necessary for the optical power input at the modem receiver to remain within specified limits which for DSTC 454 means that the mean power received is within the range $-34\ \mathrm{dBm} < P_{in} < -11\mathrm{dBm}$ (the power in dBm is defined in accordance with $P_{dBm} = 10\log(P_{in}/1\ \mathrm{mW})$).

The most certain way to check the power supplied to the receiver is to measure the optical power delivered at the end of the cable with a photometer. This is possible as the mean power output from the DSTC 454 is always constant. All that is necessary is that supply power is applied to the transmitting modem.

If a photometer is not available or the equipment is only in the planned stage it is possible to check by calculation that the power received remains within the limits specified. The method of calculation is described in the Section 2.6.1 Upper power limit and Section 2.6.2 Lower power limit.

How the maximum cable length of a particular cable type is calculated is presented in Section 2.6.3 Maximum length.

2.6.1 Upper power limit

The maximum permitted mean optical power into the receiver is -11 dBm (exceeding this limit causes no damage but the function of the modem cannot be guaranteed). As the maximum transmitted mean power for the fiber dimensions 62.5/125, 85/125 and 100/140 µm exceeds this value (see Section 6.6.2 Optical LDB-cable) a certain attenuation is required in the cable to avoid exceeding the upper power limit. The minimum attenuation required when the modem is strapped for full power is:

Fibre dimension	62.5/125	85/125	100/140 µm
Minimum attenuation	4 dB	5 dB	7 dB

A check should be performed by calculation if the length of the cable is less than 2000 m (6,561 ft.). If it is suspected that the cable attenuation is less than the value specified above, the modem is to be strapped for reduced power.

When fibre of dimension 50/125 is used, the modem can always be strapped for full power (output power does not exceed -11 dB).

The total attenuation (designated D below) for an optical fibre link is calculated using the following equation:

$D = L*A + d_s*N_s + d_k*N_k(1)$

where

L = Length of cable in km

A = Cable attenuation per km

d_s = Attenuation for welded splice which is normally in the range 0.1-0.5 dB

N_s = Number of welded splices

d_k = Attenuation for contact splice normally in the interval 0.5-2.0 dB

N_k = Number of contact splices

The calculation method is illustrated by the following example.

E.g.Assume that a 100/140 µm fibre is to be used over a distance of 1 km and 3 splices are necessary (2 contact splices and one welded splice). The minimum attenuation for the cable is 4 dB/km.

The minimum attenuation for the cable is obtained in accordance with equation (1):

$D = 1*4 + 0.1*1 + 0.5*2 = 5.1$ dB

As 5.1 dB is less than the minimum attenuation specified above (7 dB) the modem is to be strapped for reduced power.

2.6.2 Lower power limit

The lower power limit is checked in a similar manner except that maximum attenuation in cable and splices must be assumed.

The maximum permitted attenuation in the cable plus splices for the different fibre dimensions is:

Fibre dimension	50/125	62.5/125	85/125	100/140 µm
Maximum attenuation	17 dB	21 dB	22 dB	24 dB

The calculation method is illustrated with the following example:

E.g.Assume that a 50/125 µm fibre is to be used over a distance of 2,500 meter (8,202 ft.) and that 2 splices are required, one welded splice and one contact splice. The maximum attenuation for the cable is 3 dB/km.

The maximum attenuation is obtained in accordance with the equation (1) in Section 2.6.2 Lower power limit.

D = 2.5*3 + 0.5*1 + 2.0*1 = 10.0 dB

The maximum permitted attenuation for 50/125 µm fibre cable is 17 dB in accordance with the above. This means that there is a sufficient margin of 7 dB in this case.

NOTE

At the time of installation, a sufficient margin should always be ensured to allow for the effects of possible future cable breaks, relocations etc. The margin is selected taking into account the possible future power requirements. A recommended margin is at least 6 dB.

Note that 2 splices are often required to repair a cable break.

2.6.3 Maximum length

The absolute maximum length in km is obtained by dividing the maximum attenuation for the relevant cable dimension (given above in section 2.6.2) by the maximum attenuation per km for the cable. An 85/125 µm cable with maximum attenuation 4 dB/km gives for example a maximum length 22/4 = 5.5 km (18,044 ft.).

The maximum length must however be reduced to obtain the margin always required with new installations. If a margin of 6 dB is required in this case, a maximum length of (22 - 6)/4 = 4 km (13,123 ft.) is obtained.

If splicing is necessary, the maximum length is reduced ever further.

If it is assumed that two welded slices are required the final maximum length becomes

(22 - 6 - 2*0.5)/4 = 3.75 km (12,303 ft.).

The maximum length is thus considerably dependent on cable attenuation, margins and number and type of splice.

Chapter 3 Installation of MasterFieldbus

3.1 General

This chapter describes the installation of the actual buses,i.e., SDB and LDB, modems, multiplexer and terminating units. The installation of the remote I/O units is presented in Chapter 9 Installation of S400 I/O Units.

In order for a high-speed communications system to function correctly it is **extremely important** that the instructions for its installation are followed exactly. An improperly installed system can certainly function, but it may also be sensitive to interference and prone to intermittent problems which are extremely hard to locate.

The following sections provide practical advice and instructions for installing the various MasterFieldbus components. If these instructions differ in any way from the general instructions for installing the Process Station system, then the instructions in this book take precedence.

3.2 Cable Installation

In general, the following guidelines apply with regard to all cable installation within the MasterFieldbus system:

- SDB and LDB **can be** installed together
- LDB **can be** installed together with other process cables and power supply lines
- SDB **must be** installed at least 5 cm away from process cables and power supply lines
- All cables **must be** installed at least 10 cm from power cables whose phase voltage exceeds 250V
- Optic LDB can be mounted without regard to electrical interference effects.

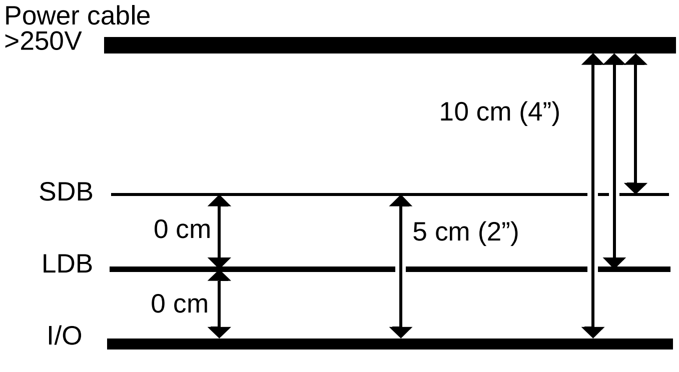


Figure 3-1. Installation of ABB MasterFieldbus and Process Cables

3.3 Terminations

Faulty terminations are a very common cause of bus network interference. The basic rules concerning ABB MasterFieldbus terminations are as follows:

- The primary SDB must be connected to the bus controller via connection unit and cable at **one of the end points**. The bus controller contains a built-in active termination.
- Each secondary SDB must be terminated with the active terminating unit DSTC 404 at the end which is connected to the modem.
- The other ends of both the primary and secondary SDB must be terminated using a passive terminating unit; DSTC 406.
- The LDB end points must be terminated with 75 ohm BNC terminating plugs.

The terminations are described in more detail in Section 3.4 Connection of bus network. Optical LDB do not need any termination.

3.4 Connection of bus network

3.4.1 General

Figure 3-2 depicts the various connection alternatives offered by ABB MasterFieldbus. These alternative are described in detail in the material following Figure 3-2.

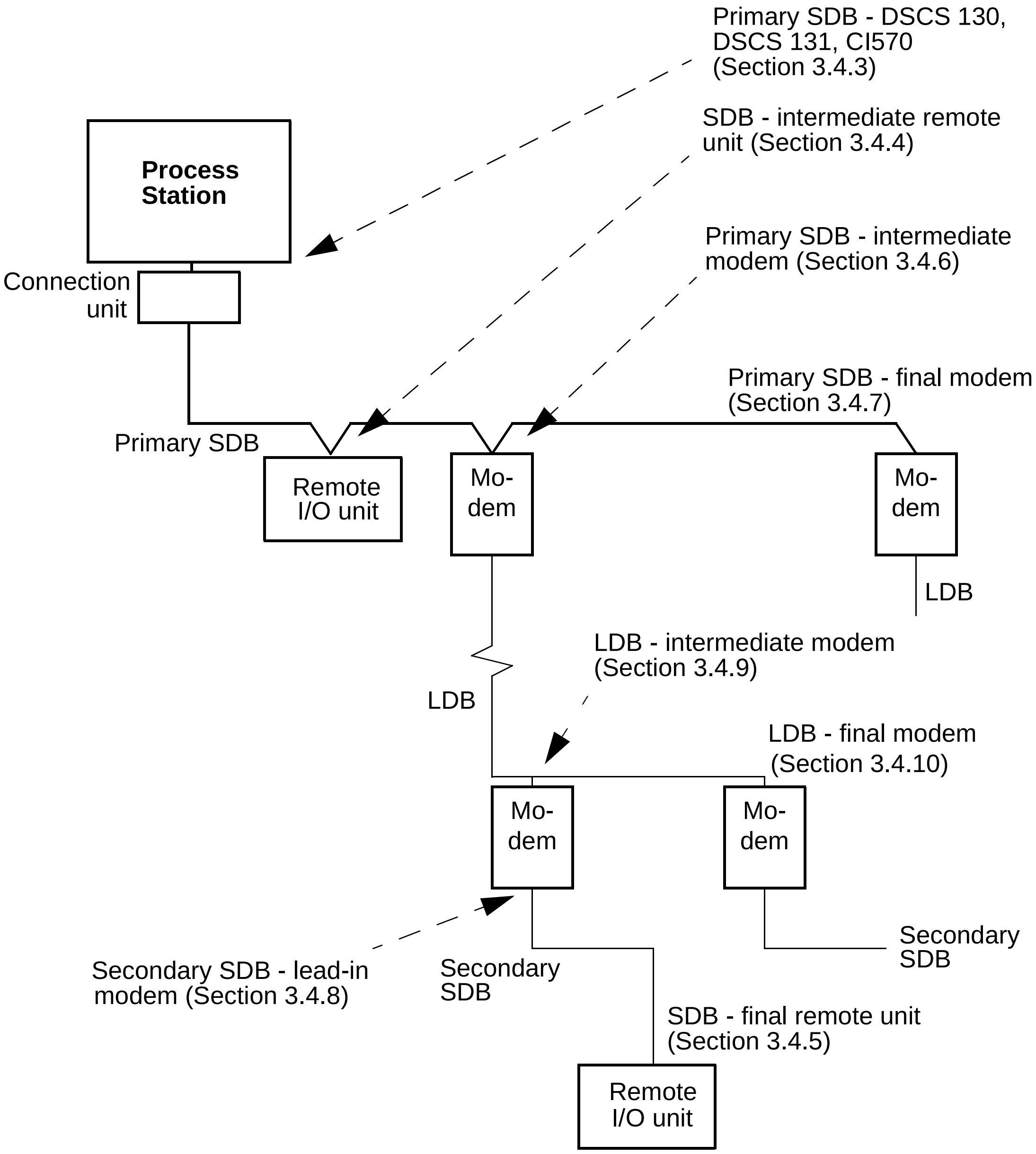

Primary SDB - DSCS 130, DSCS 131, CI570 (Section 3.4.3)
SDB - intermediate remote unit (Section 3.4.4)
Process Station
Primary SDB - intermediate modem (Section 3.4.6)
Connection unit
Primary SDB - final modem (Section 3.4.7)
Primary SDB
Remote I/O unit
Mo-dem
Mo-dem
LDB
LDB - intermediate modem (Section 3.4.9)
LDB
LDB - final modem (Section 3.4.10)
Mo-dem
Mo-dem
Secondary SDB
Secondary SDB - lead-in modem (Section 3.4.8)
Secondary SDB
SDB - final remote unit (Section 3.4.5)
Remote I/O unit

Figure 3-2. The various ways of connecting buses, modems and remote I/O units in a MasterFieldbus system

3.4.2 Connection of SDB and LDB - General

The following rules generally apply with regard to the connection of SDB’s to modems and remote I/O units:

- The SDB’s shielding **must be** grounded. The shielding is grounded via a connector terminal board at each branching and at the ends. See Figure 3-3.
- All cable shielding connections **must be shorter than 5 cm (≈2”)**.
- In- and out-going cable strands in each intermediate unit must be connected in the same terminal in the terminal's detachable section.
- In- and out-going cable shielding in each intermediate unit must be connected by a connecting link between terminals 1 and 2 in the terminal's detachable section.
- Relieve the screw terminal by bundling in- and out-going SDB’s in intermediate units, with cable straps.
- The white strands of the various wire pairs must not be confused with one another. Each white strand is marked with rings of the same color as the colored strand with which it belongs.

The following rules generally apply with regard to the connection of LDB’s to modems:

- If the LDB’s shielding is grounded, it should be grounded at one point only.
- **LDB’s should not be spliced between modems**, because of the danger that a ground connection might thus be created.
- LDB’s may be connected to modems only via BNC-T connectors.
- BNC-T connectors must be connected directly to the modems, with no intermediate coaxial cable.

Connection of optical LDB is described in Section 3.4.11 Connection of optical modem.

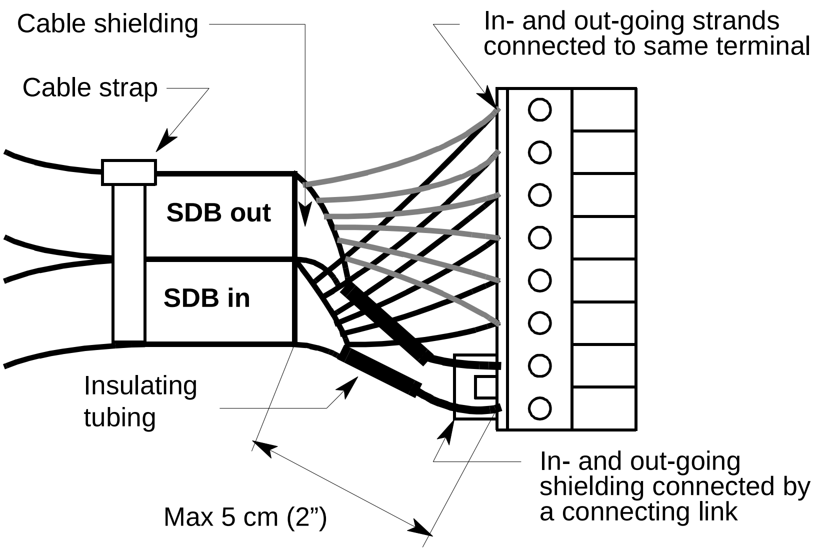

Cable shielding
In- and out-going strands connected to same terminal
Cable strap
SDB out
SDB in
Insulating tubing
In- and out-going shielding connected by a connecting link
Max 5 cm (2”)

Figure 3-3. Connection of SDB to the detachable section of a plug-in terminal in a modem or a remote unit

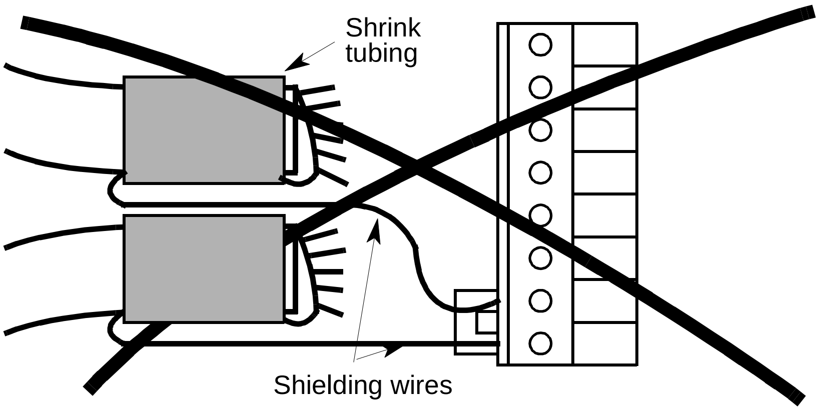


Figure 3-4. Common but **incorrect** *connection of SDB cable shielding. The long shielding wires increase sensitivity to interference*

3.4.3 Connection of primary SDB to Bus Controller

3.4.3.1 DSCS 130 and not redundant DSCS 131

The first link in ABB MasterFieldbus after DSCS 130 and connection unit DSTC 408 always consists of an SDB (see Figure 1-3).

- Mount DSCS 130 in the rack.
- Connect cable DSTK 127 to the circuit board's X2 connector by means of an RTXR connector.
  - – Connect the loose RXTR connector wires to a chassis ground, i.e., the rack. Do not extend the wires.
- Connect the other end of DSTK 127 to connector X80 on connection unit DSTC 408, which is mounted in mounting unit DSRA 110 in the rear portion of the electronics cabinet, in the same manner as the other ABB Master connection units. Make sure to achieve good metallic contact between the connection unit and the mounting unit.
- Connect SDB to the detachable section of the connection unit's terminal X90 in the manner described in Section 3.4.2 Connection of SDB and LDB - General.

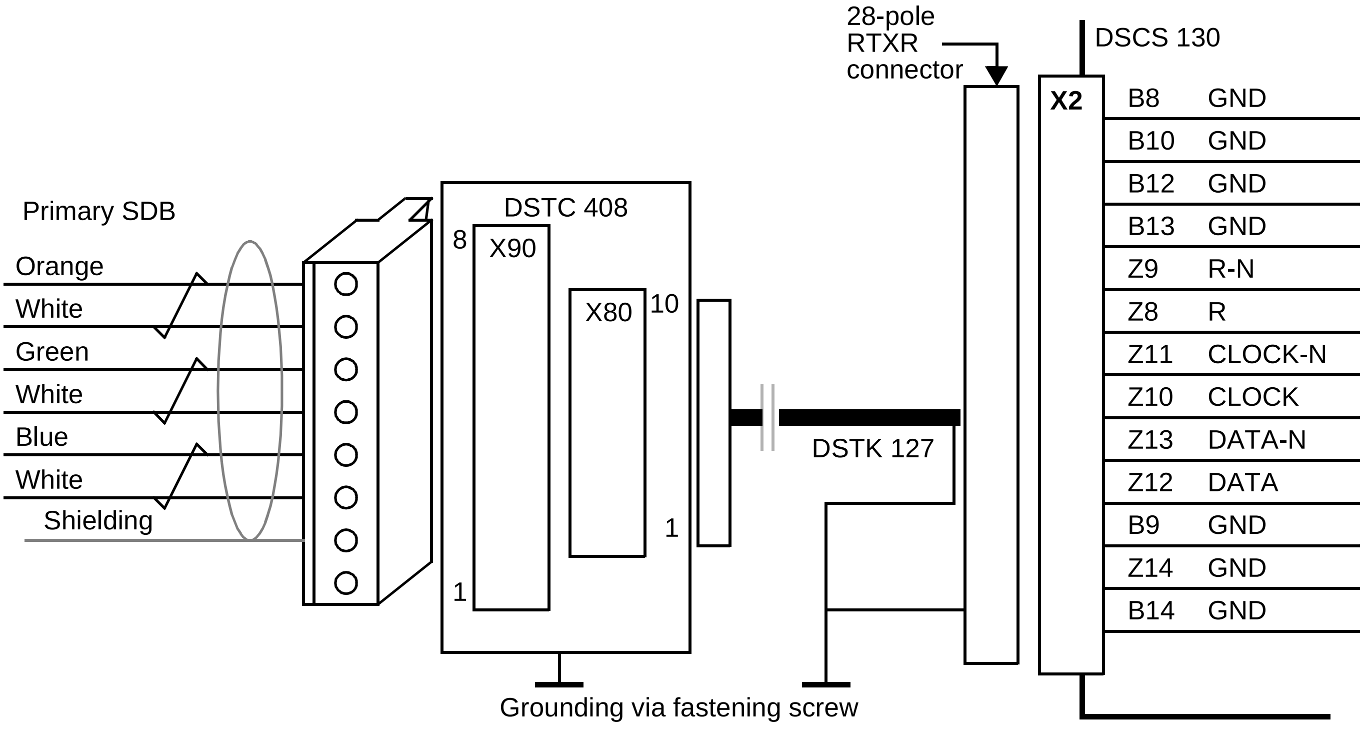


Figure 3-5. Connection of primary SDB to DSCS 130

3.4.3.2 Redundant DSCS 131

The first link in the ABB MasterFieldbus after DSCS 131 and connection-unit/units DSTC 408 is always a short distance bus. (see Figure 1-3 and Figure 1-4).

- Mount the DSCS 131 in the subrack
- Connect the cable DSTK 132 to the contact X2 on the circuit board by means of the RTXR connector. - Connect the loose conductors at the RTXR connector to the chassis ground i.e. to the subrack structure. Do not extend the conductors. Connect the other end of the DSTK 132 to the connectors X80 on the connection units DSTC 408 which are installed on the mounting bar DSRA 110 at the rear of the electronics cabinet, in the same way as for other connection units in ABB Master units. Ensure that there is adequate metallic contact between the connection unit and the mounting bar.
- Connect the SDB to the extractable part of the connection unit terminal X90 as described in Section 3.4.2 Connection of SDB and LDB - General.

The jumper “REDM” in the X2 connector indicates to the control board that it is included in a configuration incorporating redundancy. The cable DSTK 127 which does not have this jumper is used in single bus configurations (see Section 3.4.3 Connection of primary SDB to Bus Controller).

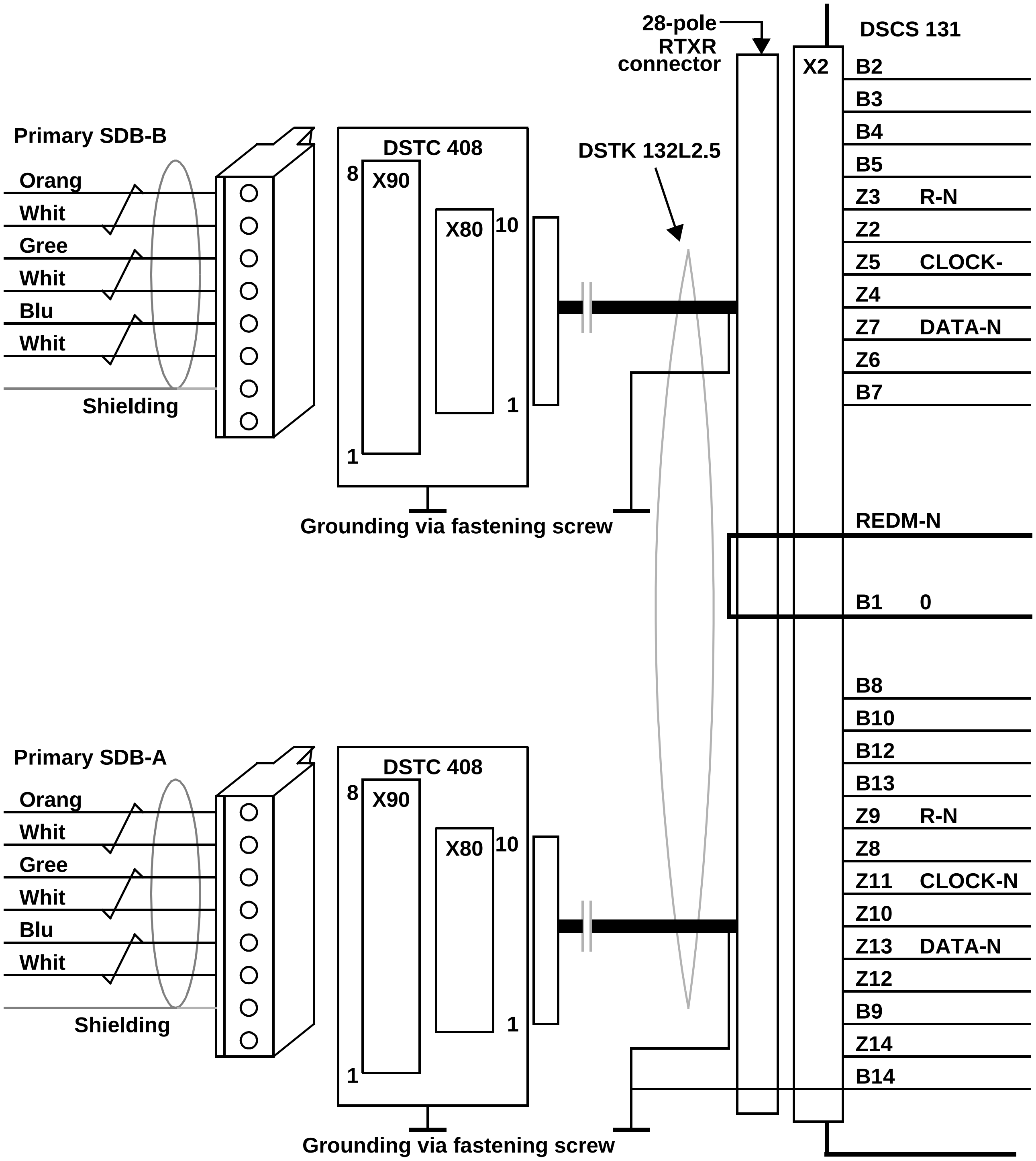


Figure 3-6. Connection of redundant primary SDB to DSCS 131

3.4.3.3 Non-redundant CI570

The first link in ABB MasterFieldbus after CI570 and connection unit TC570 always is an SDB.

- Mount CI570 in one slot of the Carrier Device SC510 or in one slot of the Advant Controller 410 CPU (for conditions - see User's Guide for the Controller)
- Connect cable TK570 to the front connector X4 of the CI570 module
- Connect the other end of TK570 to connector X1 on connection unit TC570, which is mounted on a separate panel
- Connect SDB to the detachable section of the connection unit's terminal X2, SDB-A, as described in Section 3.4.2 Connection of SDB and LDB - General.

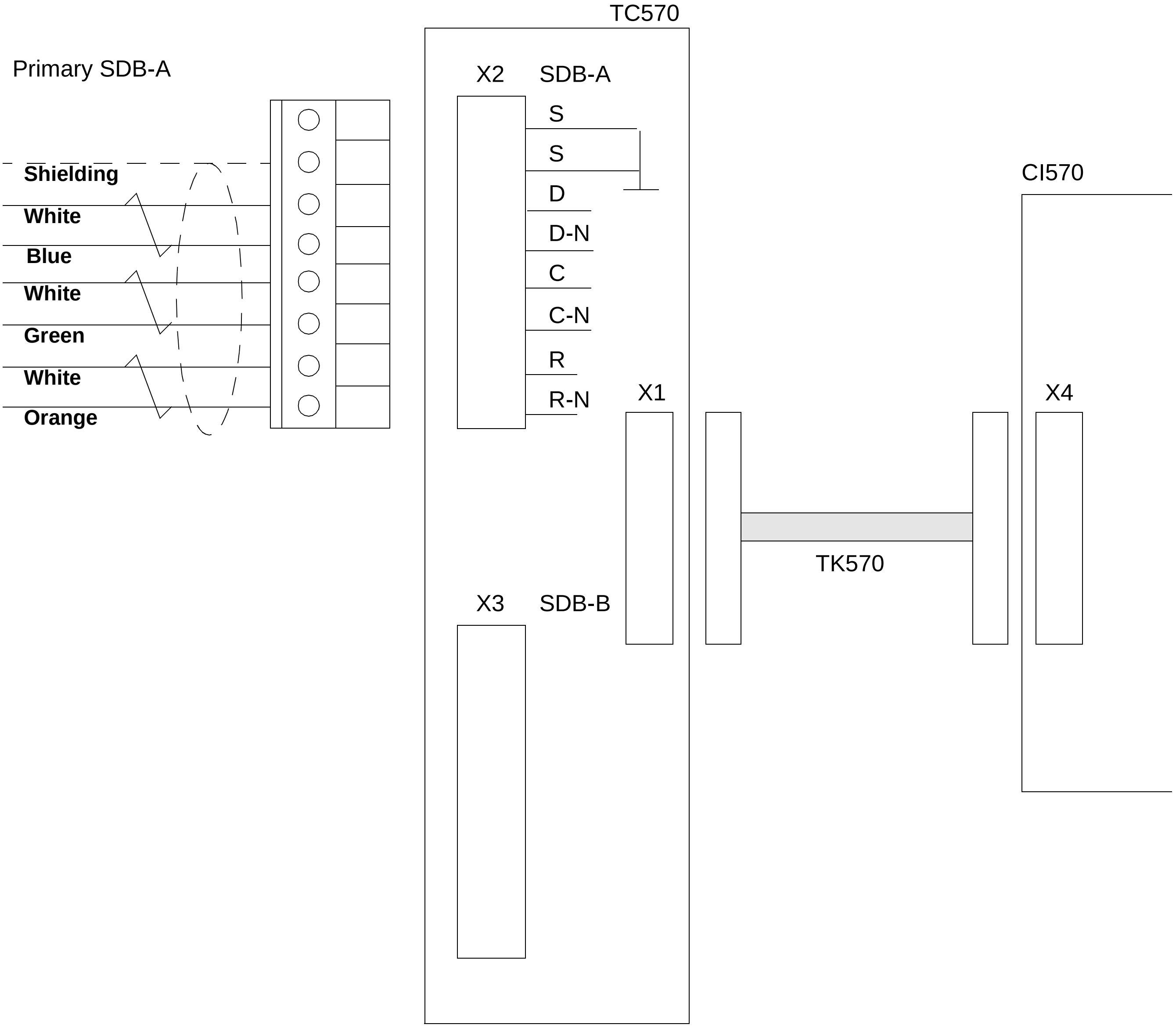


Figure 3-7. Connection of Primary SDB to CI570

3.4.3.4 Redundant CI570

The first link in ABB MasterFieldbus after CI570 and connection unit TC570 always is an SDB. In redundant application, two SDB's are connected to the connection unit.

- Install CI570 and connect to TC570 in the same manner as described for non-redundant configuration with CI570
- Connect the first SDB to the detachable section of the connection unit's terminal X2, SDB-A, and the second SDB to X3, SDB-B, as described in Section 3.4.2 Connection of SDB and LDB - General
- Check configuration for redundant operation on DB-element.

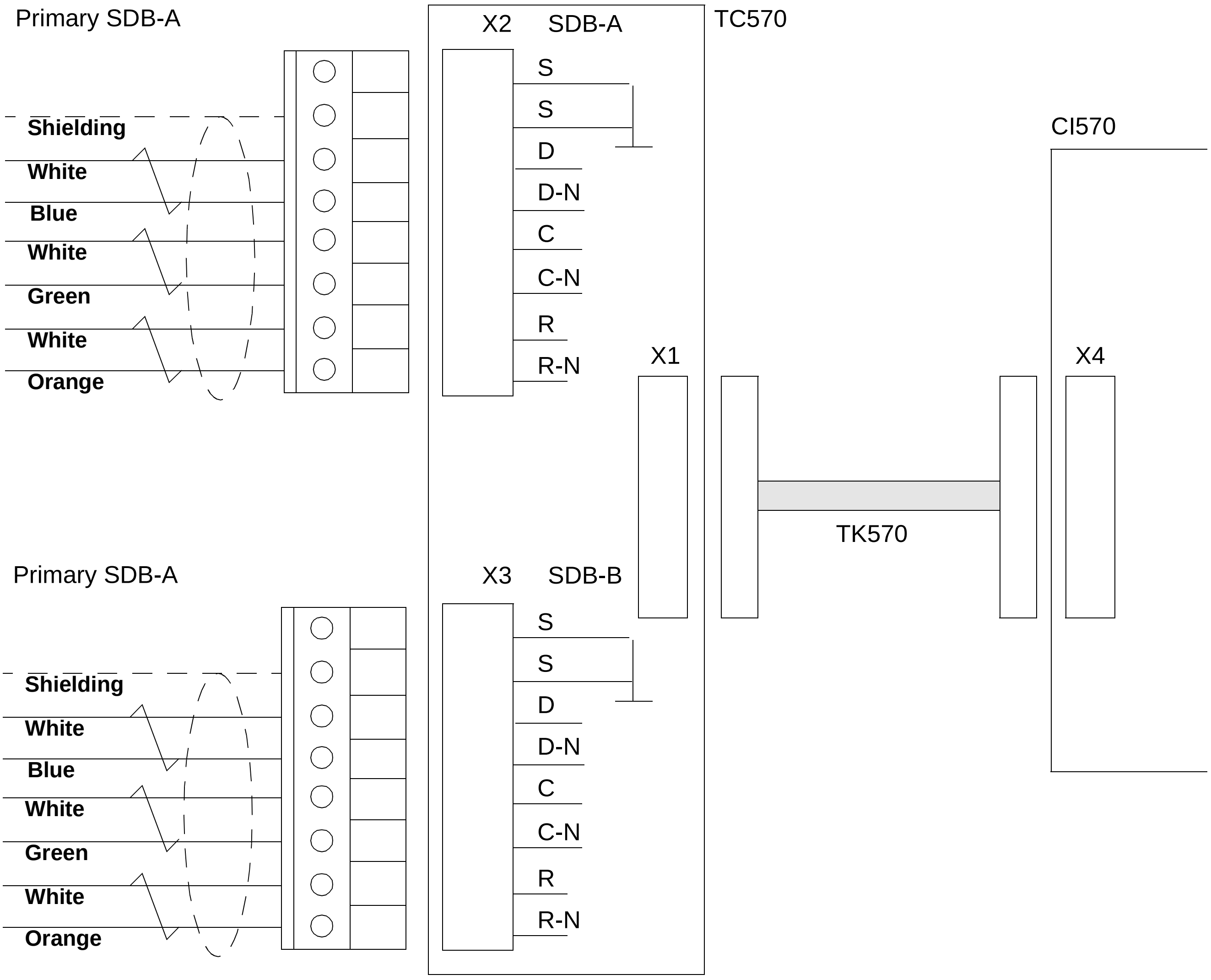


Figure 3-8. Connection of Redundant Primary SDB to CI570

3.4.4 Connection of SDB to Intermediate Remote Unit

Connect SDB to the detachable section of the remote unit’s terminal X16 as per Figure 3-9 and the instructions in Section 3.4.2 Connection of SDB and LDB - General.

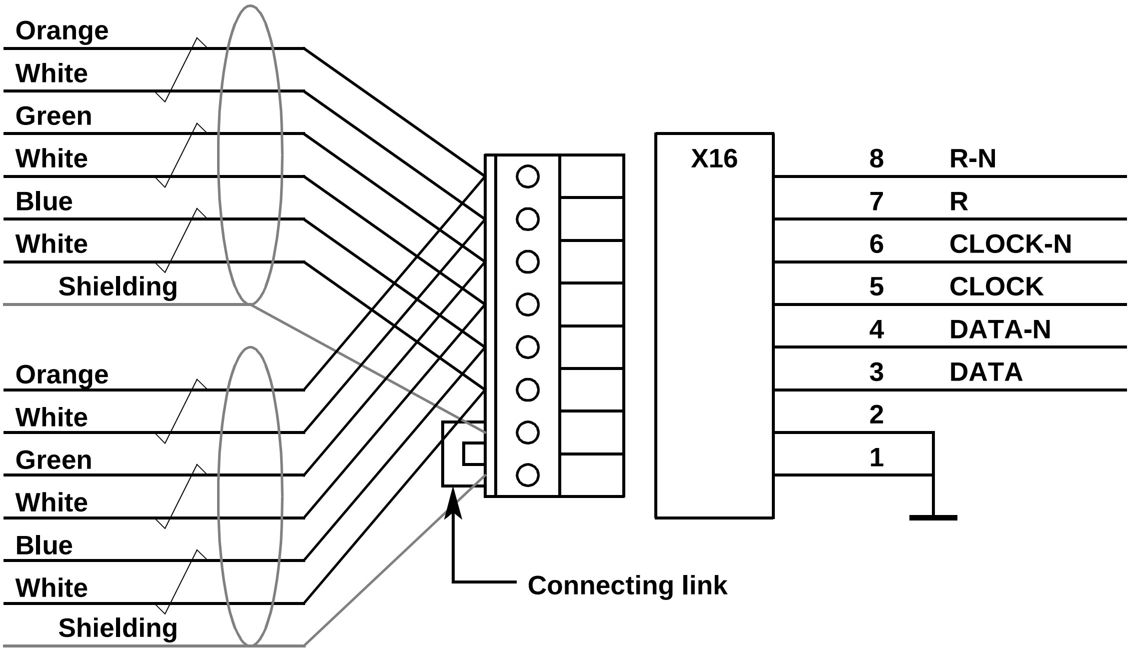


Figure 3-9. Connection of SDB to Intermediate Remote Unit

3.4.5 Connection of SDB to Final Remote Unit

Connect SDB to the detachable section of the remote unit's terminal X16 as per Figure 3-10 and the instructions in Section 3.4.2 Connection of SDB and LDB - General. Terminate SDB with terminating unit DSTC 406.

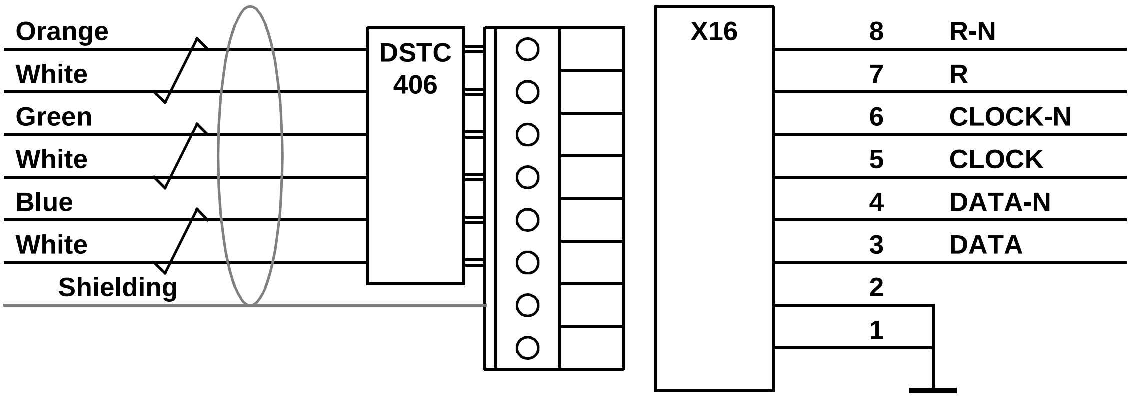


Figure 3-10. Connection of SDB to Final Remote Unit

3.4.6 Connection of Primary SDB to Intermediate Modem

Connect SDB to the detachable section of the modem's terminal X12 as per Figure 3-11 and the instructions in Section 3.4.2 Connection of SDB and LDB - General.

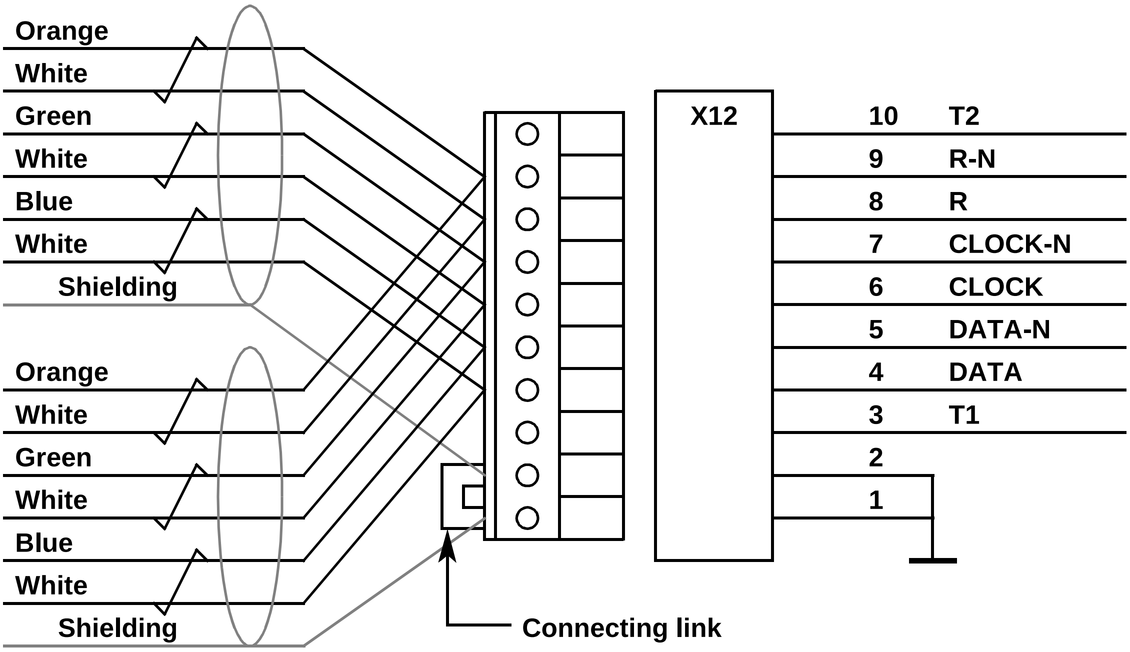


Figure 3-11. Connection of Primary SDB to Intermediate Modem

3.4.7 Connection of Primary SDB to Final Modem

Connect SDB to the detachable section of the modem’s terminal X12 as per Figure 3-12 and the instructions in Section 3.4.2 Connection of SDB and LDB - General. Terminate SDB with terminating unit DSTC 406.

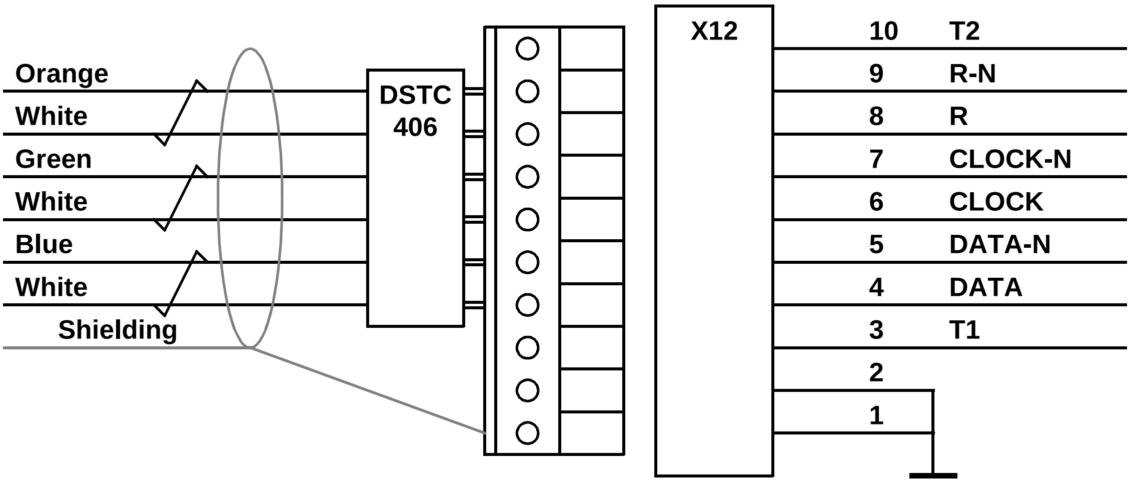


Figure 3-12. Connection of Primary SDB to Final Modem

3.4.8 Connection of Secondary SDB to Lead-in Modem

Connect SDB to the detachable section of the modem’s terminal X12 as per Figure 3-13 and the instructions in Section 3.4.2 Connection of SDB and LDB - General. Terminate SDB with terminating unit DSTC 404.

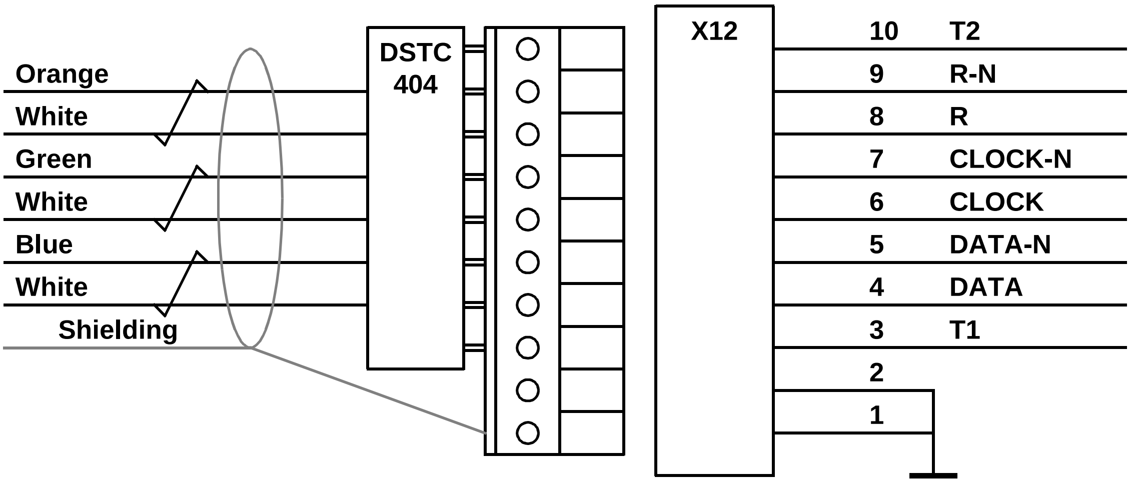


Figure 3-13. Connection of Secondary SDB to Lead-in Modem

3.4.9 Connection of LDB to Intermediate Modem

Connect LDB to the modem's socket X1 using a BNC-T connector as per Figure 3-14 and the instructions in Section 3.4.2 Connection of SDB and LDB - General.

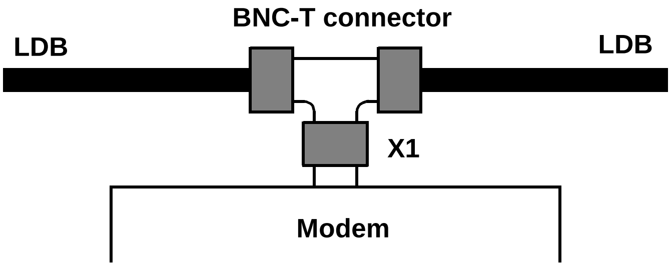


Figure 3-14. Connection of LDB to Intermediate Modem

3.4.10 Connection of LDB to End Modem

Connect LDB to the modem's socket X1 using a BNC-T connector as per Figure 3-15 and the instructions in Section 3.4.2 Connection of SDB and LDB - General. Terminate LDB with a BNC terminating plug (75 ohm).

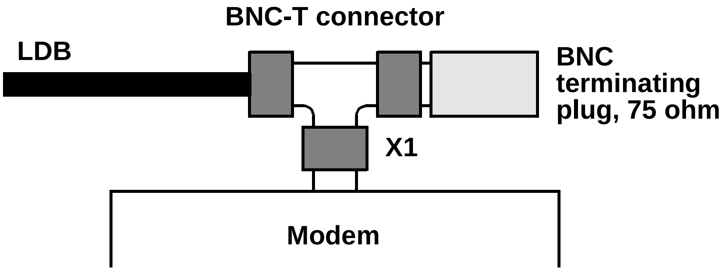


Figure 3-15. Connection of LDB to End Modem

3.4.11 Connection of optical modem

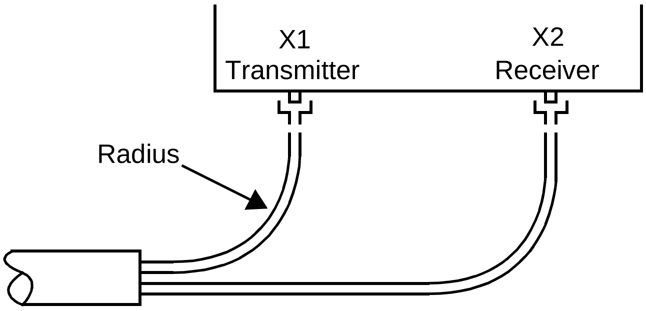


Figure 3-16. Connection of Optical LDB

The modem is connected to the dual fibre cable of the long distance bus via X1 (transmitter) and X2 (receiver).

NOTE

It is recommended that opto.connectors be screwed in place with the fingers as the threads on the connectors can be easily damaged if tools are used.

Sufficient space should remain beneath the modem to permit a certain minimum bending radius of the cable (R in the figure above). This radius depends on the cable type and is normally 100 mm for apparatus cable and cable for indoor industrial environments; for underground and submarine cable, a radius equal to or greater than 200 mm (≈ 8”) is normally required. The manufacturer of the cable should be contacted in the event of uncertainty.

The installation of optical connectors on the cable is a precision work which should be performed by specialists. The cable supplier can usually recommend such experts.

The optical connectors are of the SMA type.

3.4.12 Connection of SDB to intermediate multiplexer DSTC 456

Connect SDB-A and SDB-B to the pluggable part of the terminals X1 and X2 of the multiplexer in accordance with Figure 3-17 and in accordance with the instructions in Section 3.4.2 Connection of SDB and LDB - General.

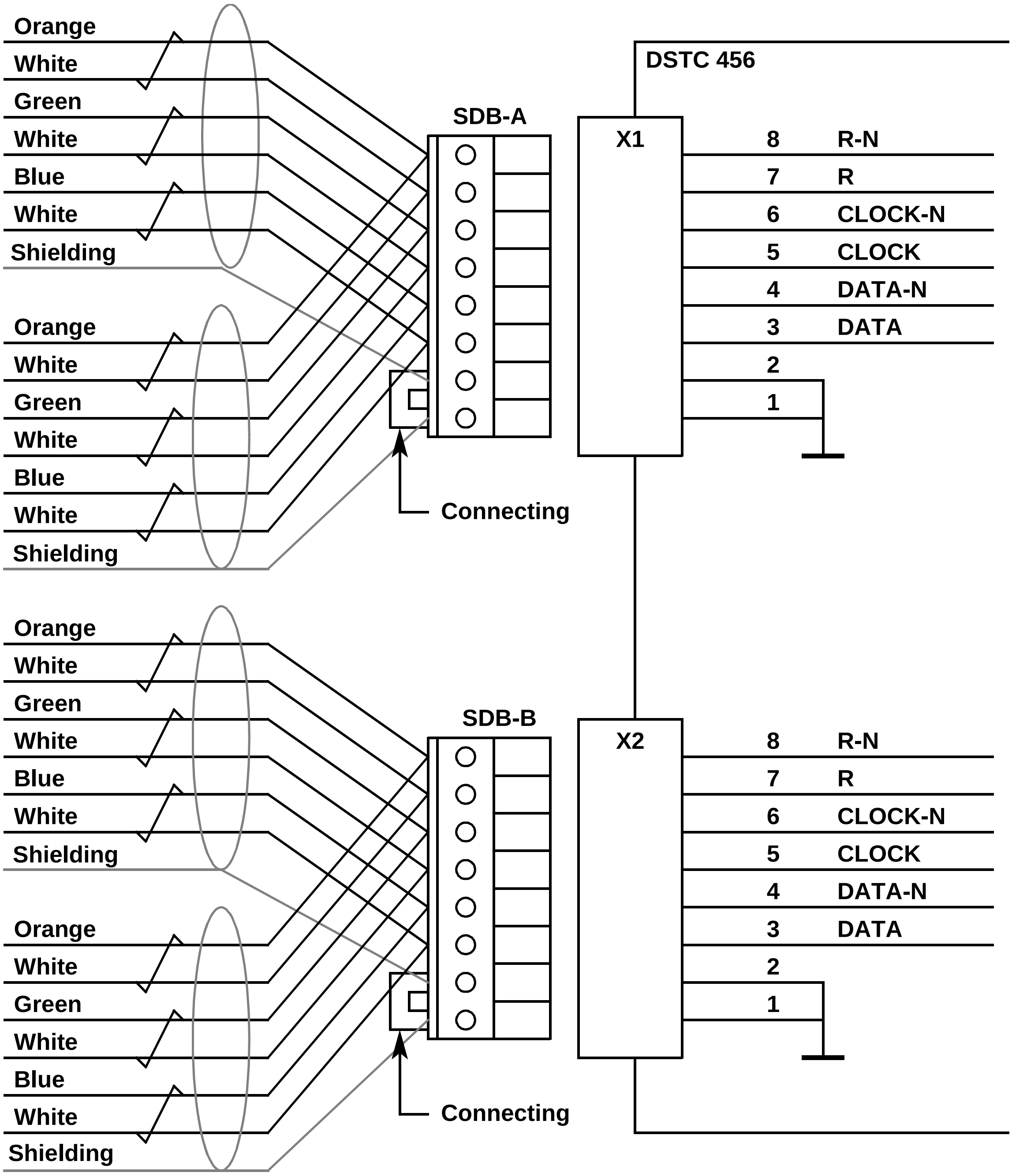


Figure 3-17. Connection of SDB to intermediate multiplexer

3.4.13 Connection of SDB to final multiplexer DSTC 456

Connect SDB-A and SDB-B to the pluggable part of the terminals X1 and X2 of the multiplexer in accordance with the instructions in Section 3.4.2 Connection of SDB and LDB - General and as shown in Figure 3-18. Terminate the SDB with the termination unit DSTC 406

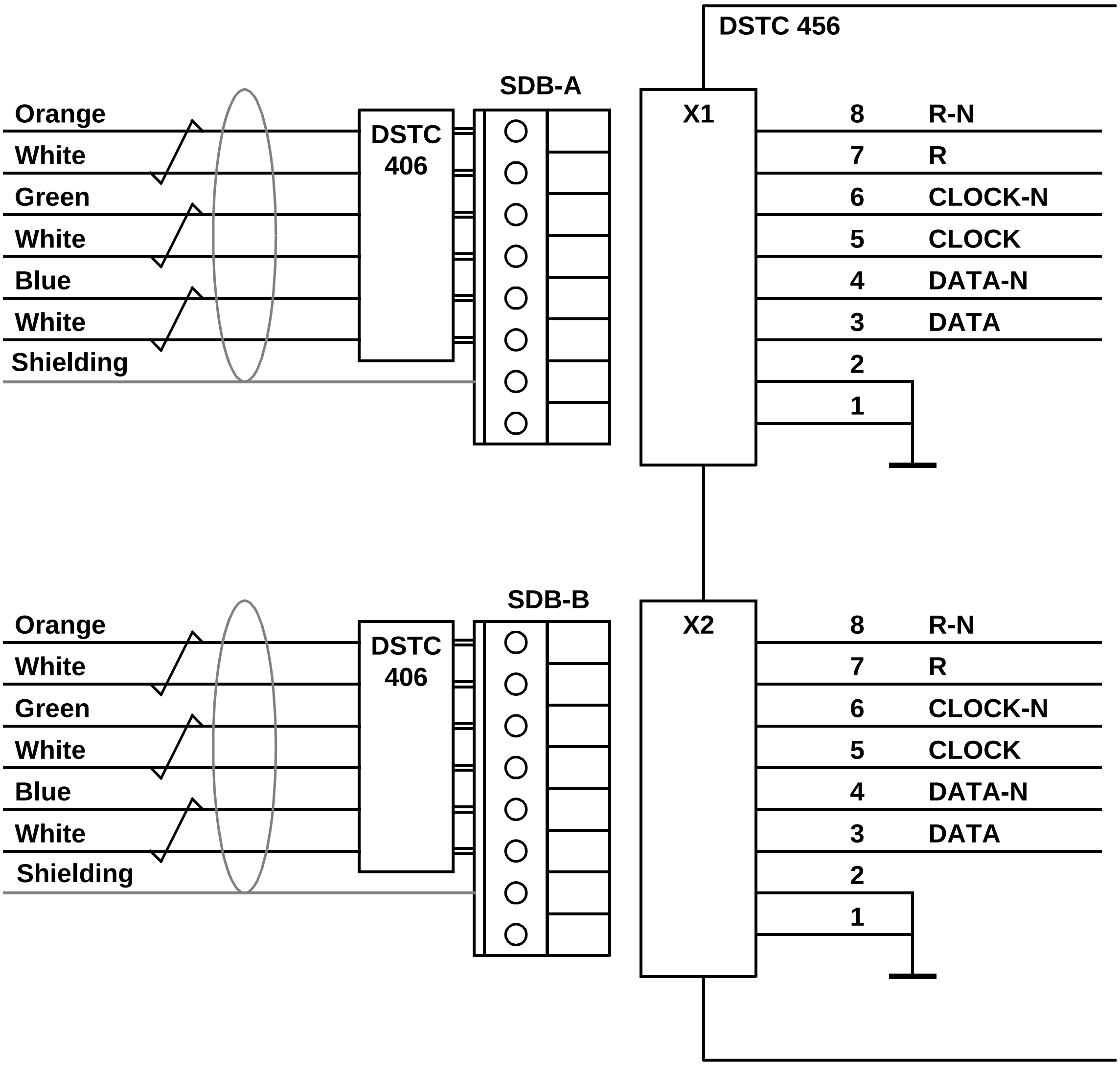


Figure 3-18. Connection of SDB to final multiplexer

3.4.14 Connection of secondary SDB to introductory multiplexer

Connect SDB-C to the pluggable part of the terminal X12 of the multiplexer in accordance with Figure 3-19 and the instructions in Section 3.4.2 Connection of SDB and LDB - General. Terminate SDB-C with the termination unit DSTC 404.

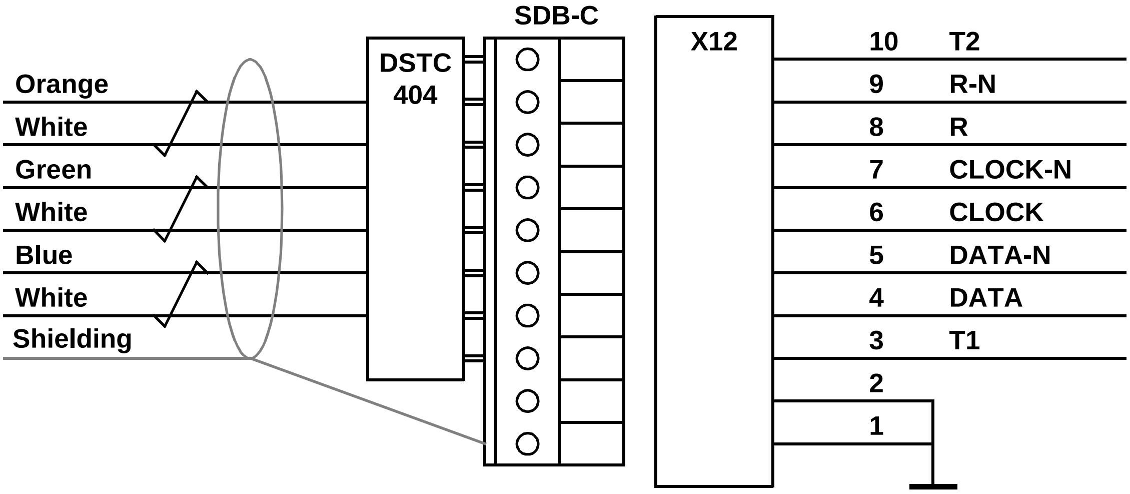


Figure 3-19. Connection of secondary SDB to introductory multiplexer

3.5 Grounding of SDB

All units, including expansion units, modems and DSCS 130 which are connected to the **same SDB** must be connected to one another in an electrically stable manner.

This can be achieved by mounting the units on the same DIN rails, on the same metallic mounting plate, in the same metal cabinet, or in different metal cabinets which are connected to one another via a ground wire system.

If the units are not installed in accordance with the above, or if the CMV (Common Mode Voltage) is expected to exceed ±7 V, a ground wire with an area of at least 10 mm^2 must be connected in parallel with SDB. See Figure 3-20.

See Section 3.7.3 Connection of power supply regarding protective grounding.

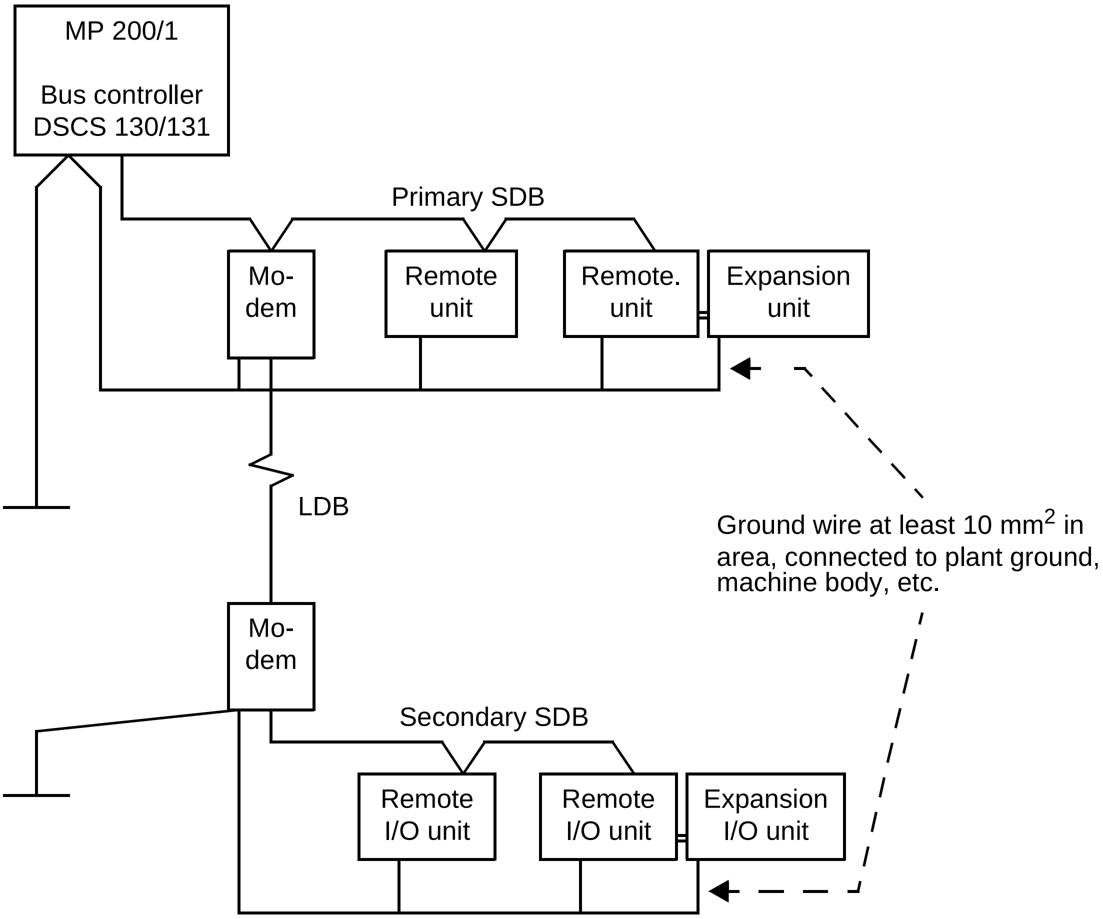


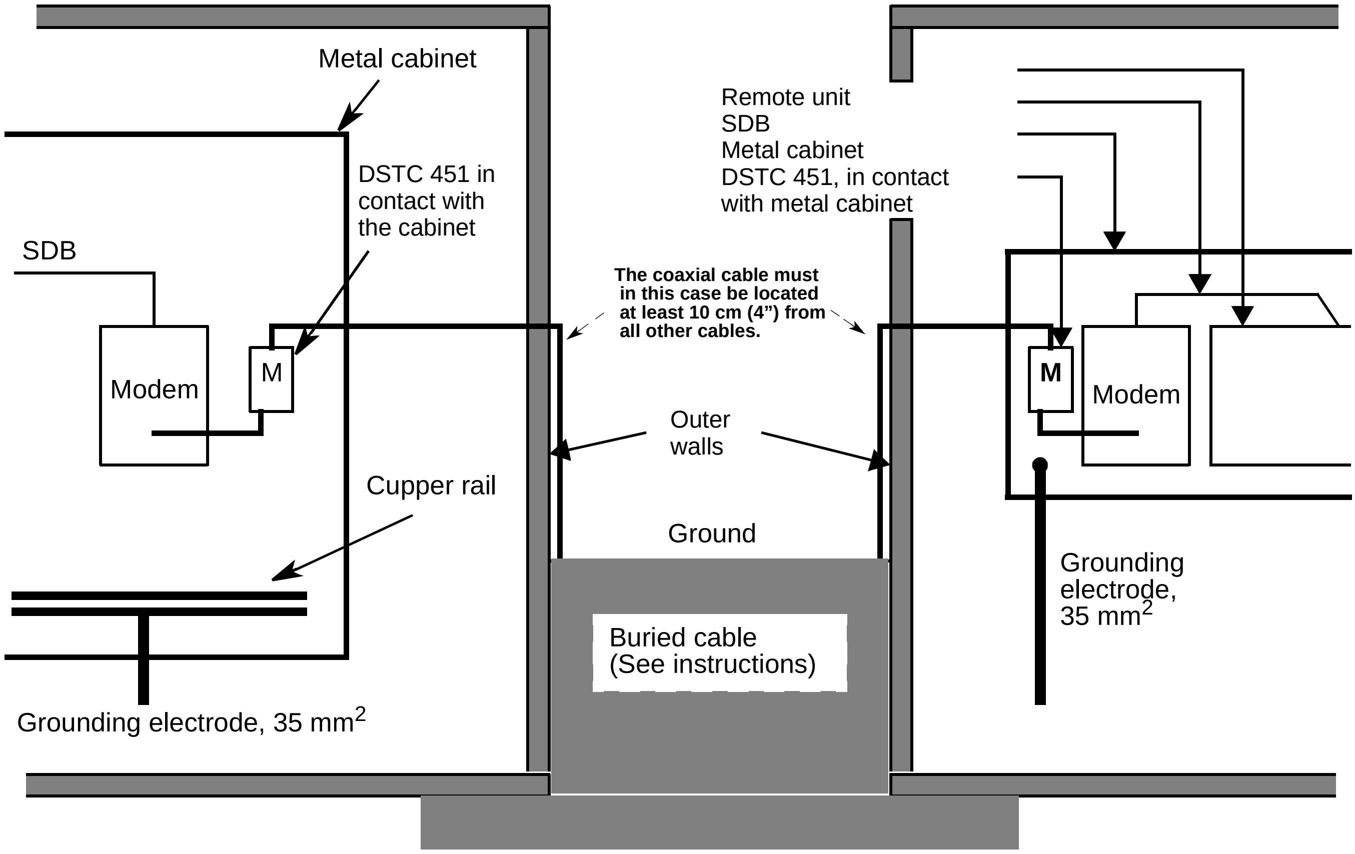
Figure 3-20. Grounding of units on same SDB

3.6 Laying of LDB Outdoors

When LDB is laid outdoors, the cable must be protected against direct influence by lightning. This can be achieved either by burying the cable or by protecting it with existing metal part in the plant (i.e. cable tracks, pipes. etc.) When the cable is not buried it must be protected against power surges, even in cases where extremely short lengths of cable are being exposed. This protection is provided by surge protector DSTC 451, which consists of a small box containing gas discharge tubes and an insulated inlet with a BNC connection.

The LDB must be equipped with a surge arrester at each modem from which the LDB continues out through the outer wall.The unit must be screwed to the same metal cabinet as the modem is installed in. The grounding point of the cabinet should be connected to a grounding electrode via a wire with an area of at least 35 mm^2.

Standard RG 59 or RG 11 cable, according to the ordering instructions in this manual, is normally adequate, even for installation outdoors. However, when there is a lot of dampness present, e.g. when the cable is laid in the ground or submerged in water, a teflon or polyurethane sheathed cable should be chosen. See technical data for LDB cables. Note that a cable that runs in a conduit can be subjected to much dampness on a continuous basis due to condensation.


Metal cabinet
DSTC 451 in contact with the cabinet
SDB
Modem
M
Cupper rail
Grounding electrode, 35 mm^2
Remote unit
SDB
Metal cabinet
DSTC 451, in contact with metal cabinet
The coaxial cable must in this case be located at least 10 cm (4") from all other cables.
Outer walls
Ground
Buried cable (See instructions)
M
Modem
Grounding electrode, 35 mm^2

The coaxial cable must in this case be located at least 10 cm from all other cables

Figure 3-21. Example of LDB installation protected against surges

If there are several modems (in different cabinets) connected to the same LDB of which a part runs outdoors, a surge arrester must be placed **at each modem**. Alternatively the outdoor part of LDB may be installed as a separate point-to-point connection, protected as described above.

3.7 Modem Installation

The instructions in this section apply to both electrical and optical modems. The modems can be mounted directly on the wall, on mounting plates or on two DIN rails. The modem must be grounded in the same manner as the other units on the same SDB. This can be achieved by mounting the units on a mutually conductive base, such as a mounting plate or DIN rails. If the mounting surface is not conductive then grounding connections must be made by running ground wires to each unit's bottom edge. Such wires must have a minimum area of 10 mm^2. See Section 3.5 Grounding of SDB.

3.7.1 Mounting on wall or mounting plate

Make holes as shown in Figure 3:20.

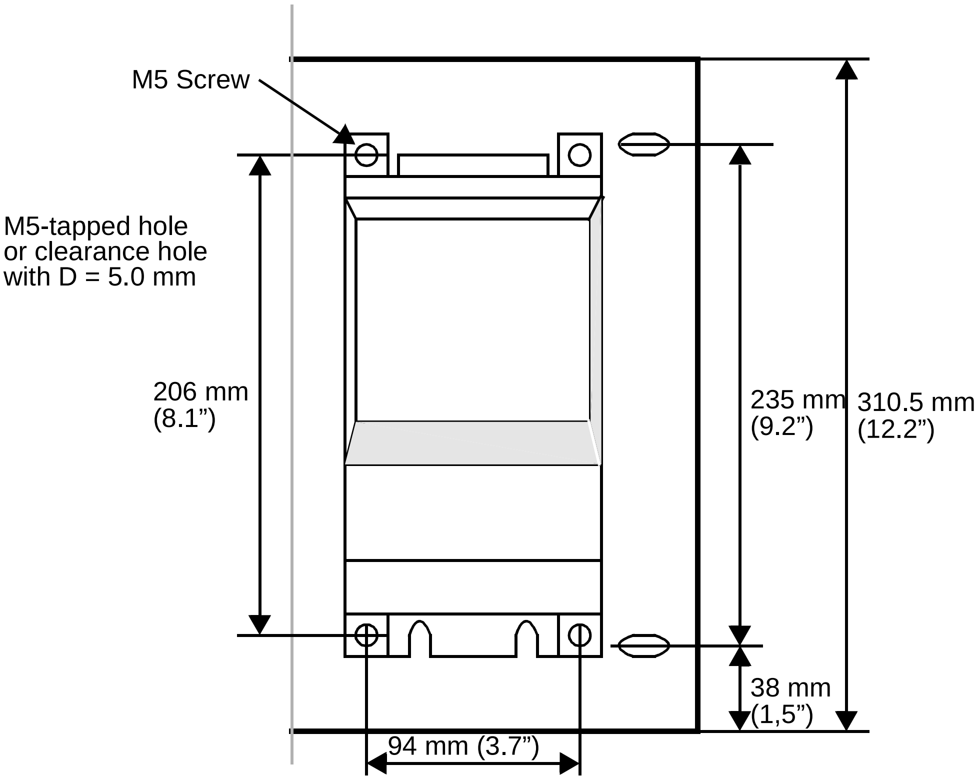


Figure 3-22. Mounting on wall or mounting plate

3.7.2 Mounting on DIN rails

Use top rails as per EN50022-35 x 7.5 with a center spacing of 133.35 mm. See Figure 3-23.

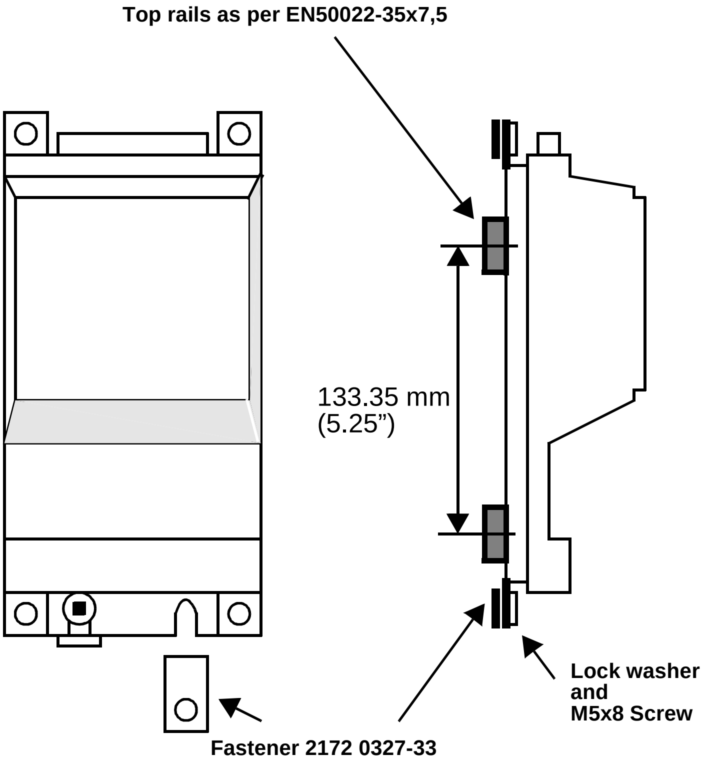


Figure 3-23. Mounting on DIN rails

3.7.3 Connection of power supply

The modem should be permanently connected to its power supply. Connect the power cable to terminal X11 as follows (see Figure 3-24):

- Connect the fuse-protected phase conductor to terminal board X11:3
- Connect the neutral conductor to:
  - X11:1 if the line voltage is 120 V a.c.
  - X11:2 if the line voltage is 230 V a.c.
- Connect the yellow/green protective ground wire to the ground screw.

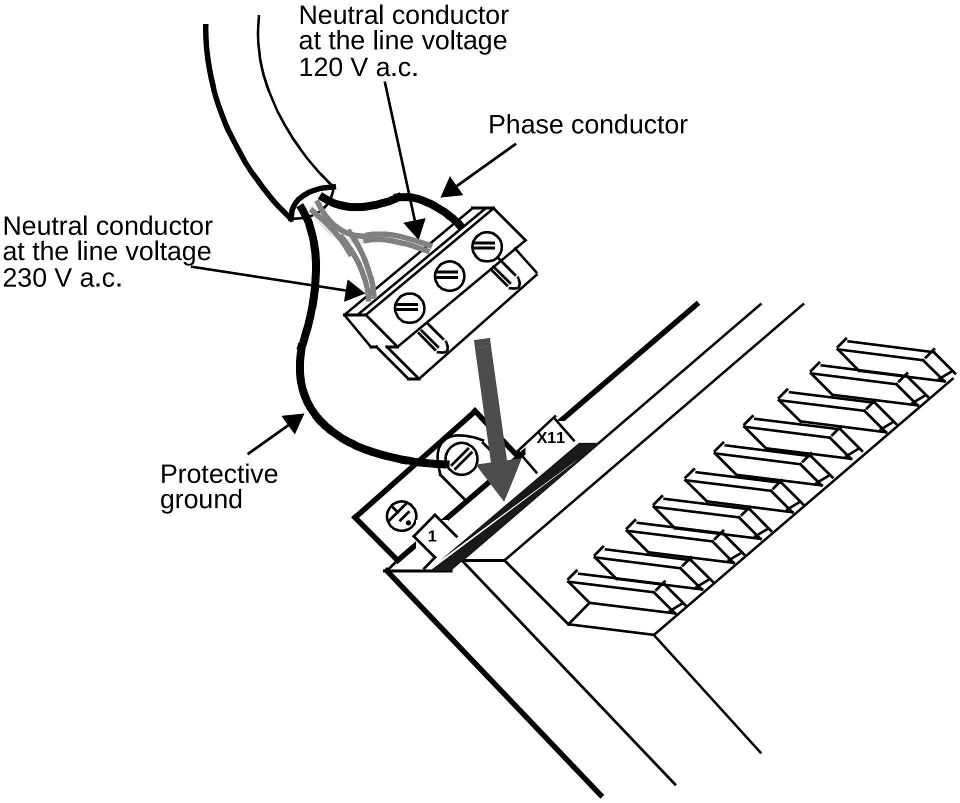

Neutral conductor at the line voltage 120 V a.c.
Phase conductor
Neutral conductor at the line voltage 230 V a.c.
Protective ground
X11
1

Figure 3-24. Connection of power supply to modem

Chapter 4 Start Up of MasterFieldbus

4.1 General

This chapter describes the setting of addresses and communication speeds on the bus controller and the modem. Corresponding settings on the data base and individual I/O units configurations are described in Chapter 10 Data Base Configuration of S400 I/O Units and Chapter 11 Start Up of S400 I/O Units and MasterPiece 51, respectively.

CI570 has no user operable straps. All user's selectable functions are configured on the database element.

4.2 Strapping of DSCS 130, DSCS 131

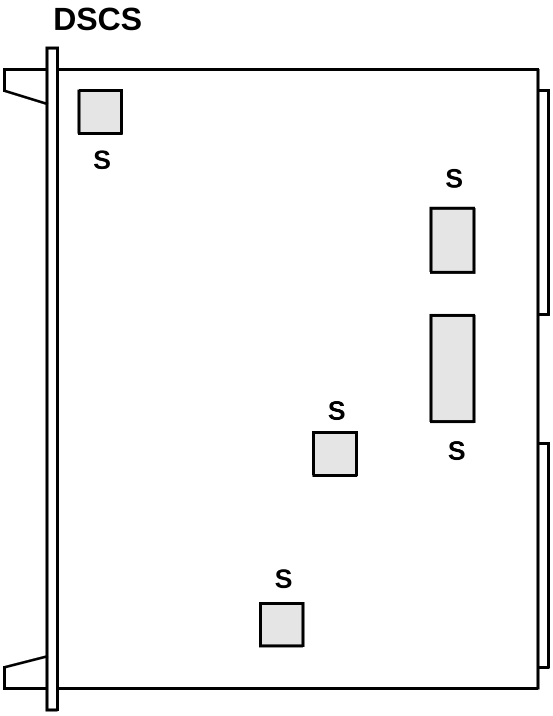


Figure 4-1. Strap groups on DSCS 130/131

4.2.1 Setting the address location

Select the address location with strap group S1. Strap as per Figure 4-2 for the various buses.

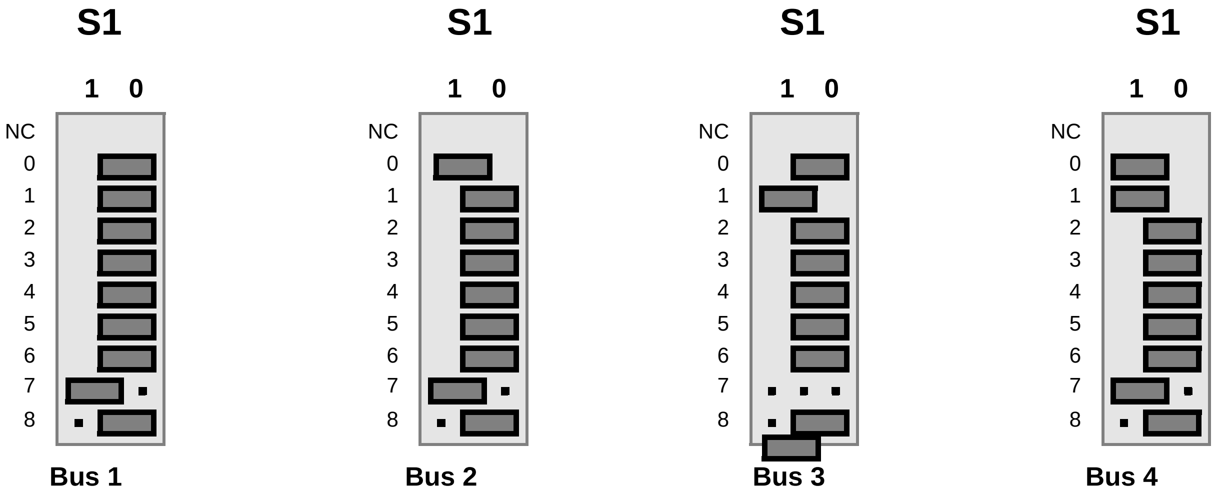


Figure 4-2. Strapping of S1 for Buses 1 - 4

NOTE

The strapping of S1:7 should be 0 instead of 1, if DSCS 131 is used in an I/O subrack.

4.2.2 Setting the addressing area

4.2.2.1 DSCS 130

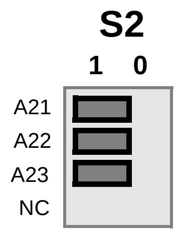


Figure 4-3. Strapping of S2 for 16 Mbyte addressing area

The disposition of strap group S2 determines the size of the board's addressing area:

- S2 should be strapped for a 16 Mbyte addressing area as per Figure 4-3 (factory setting).

4.2.2.2 DSCS 131

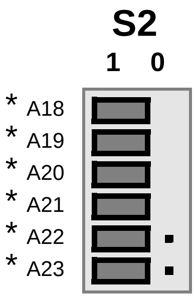


Figure 4-4. Strapping of S2 for 16 Mbyte Addressing Area

NOTE

All straps of S2 should be 0 instead of 1, if DSCS 131 is used in an I/O subrack.

The setting of jumper group S2 determines the extent of the addressing range of the board: S2 is to be jumpered for a 16 Mbyte addressing range in accordance with Figure 4-4. (delivery setting).

4.2.3 Setting the communication speed

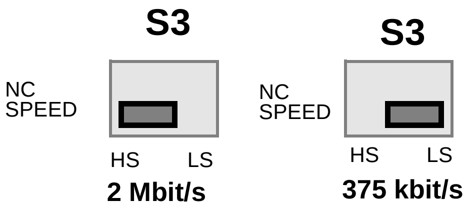


Figure 4-5. Strapping of S3 for Different Communication Speeds

Strap group S3 is used to choose between communication speeds of 2 Mbit/s and 375 kbit/s. 2 Mbit/s is normally used (factory setting). Note that **all** units connected to the bus controller must have the same speed setting as strap group S3.

4.2.4 Other strap groups

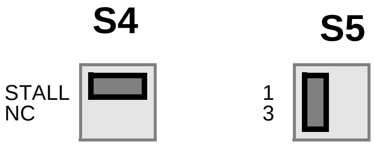


Figure 4-6. Normal Strapping of Groups S4 and S5

Strap groups S4 and S5 are used for test purposes and should be strapped as per Figure 4-6 under normal operation (factory setting).

4.3 Strapping the modem

The modem’s strap group is located on the circuit board under the plastic cover (see Figure 2-2).

4.3.1 Setting the communication speed

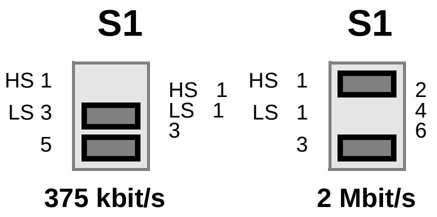


Figure 4-7. Strapping of S1 for Different Communication Speeds

Strap group S1 is used to choose between communication speeds of 2 Mbit/s (HS) and 375 kbit/s (LS) on DSTC 452. The modem comes from the factory strapped for 2 Mbit/s.

DSTC 454 works only at 2 Mbit/s.
DSTC 454L works only at 375 kbit/s.

4.3.2 Other settings

Pin row X3 is a test connector which **must not** be strapped. Potentiometers R2, R4, R5 and coil L1 have been trimmed at the factory and must not be adjusted in the field.

4.3.3 Strapping of optical output power

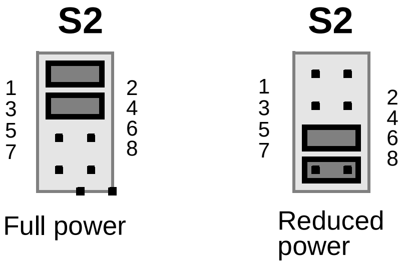


Figure 4-8. Strapping of S2 for Different Optical Power

The transmitted output power on DSTC454 is selected by strapping with strap group S2 as shown in Figure 4-8.

A suitable setting is determined with the help of Section 2.6 Power budget for optical LDB.

The modem is also equipped with strap group S1, intended for testing during production and is always to be located 1-2.

4.4 Calculation of cycle time

To get an idea of the transmission cycle time for the bus, the following formula can be used. The formula is an approximation, because the time also depends on the type of node, whether there is an expansion unit, etc.

The stated times apply to the speed 2 Mbits/s:

$T_{cycle} = 1 \text{ ms} + n_a * 1.0 \text{ ms} + n_b * 0.6 \text{ ms}$

where

n_a = the number of analog nodes

n_b = the number of binary nodes (basic units)

NOTE

DSAX 452 needs two cycles to perform a complete updating run.

Chapter 5 Troubleshooting of MasterFieldbus

5.1 General

This chapter describes specific troubleshooting procedures for the ABB MasterFieldbus.

MasterFieldbus malfunction is in evidence when communications between the Process Station and the remote I/O units are either poor or nonexistent.

With the help of the various LEDs on the bus controller and the modem it is possible to derive clues as to both the location and nature of the problem.

In addition, troubleshooting via the Configuration Tool is also possible.

5.2 Localization of Problem

Using the node indicators on the bus controller one can normally determine where in the bus structure the problem lies. If one or more LDB’s are involved in the system then modem LEDs Rx and Tx can also be utilized:

- The DSCS 130/131 node indicators glow when communications between the bus controller and the remote unit in question are functioning properly. For CI570 the node indicators are found on the connection unit.
- Rx glows when the modem is receiving information from LDB and transmitting information on SDB.
- Tx glows when the modem is receiving information from SDB and transmitting on LDB.
- SDB-A and B on the bus controller illuminate when the communication between the board and the distributed unit is performed on the corresponding bus.

5.3 Troubleshooting Sequence

1. The red fault indicator on the bus controller glows:

   Pull the board from the rack, wait 10 seconds, replace the board and wait 10 seconds, so that the Process Station has time to reinitiate the controller board. If the indicator continues to glow, the problem could be:

   a. Wrong address or otherwise faulty the bus controller strapping. See Section 4.2 Strapping of DSCS 130, DSCS 131 (not applicable to CI570).

   b. Board failure in the bus controller. Replace board.

2. Fault indicator on the bus controller does not glow:

   Check to see whether the problem unit's node indicator on DSCS 130/131, or on the connection unit when CI570 is used, is glowing.

a. Node indicator glows steadily:

   Communications with the node are in order. The problem lies in the operation of the Process Station, or possibly in the remote unit's hardware or software. In the latter case see Section 11.4 Troubleshooting remote I/O units, which concerns troubleshooting of the remote I/O units.

b. Node indicator blinks or flickers:

   Make sure of the following:

   The cables are laid correctly. See Section 3.2 Cable Installation.

   The terminations are correct. see Section 3.3 Terminations.

   The cables are connected correctly. See Section 3.4 Connection of bus network.

c. Node indicator for remote unit in question has gone out:

   Make sure of the following:

   The unit is in operation.

   The unit is configurated in the data base and that IMPL = ”1” in the data base element.

   The modem is connected correctly (see Section 3.4 Connection of bus network) and strapped properly (see Section 4.3 Strapping the modem).

   The cables are intact.

   The terminations are correct. See Section 3.3 Terminations.

   The communication speed for the remote unit is set to the same value as for the other units on the bus.

   The correct address is set on the remote unit. See Section 11.2 Setting the address and the communication speed. Remember to reinitiate the unit after a new address has been set by turning power off and then on again.

d. In configurations with redundancy - one of the media indications A and B never illuminates.

   Check the following:

   That the cables for media not functioning are intact and connected correctly.

   That the terminations are correct.

   That the multiplexers are correctly installed.

5.4 Troubleshooting via Configuration Tool

Troubleshoot with the help of the system messages and information from the data base elements.

5.4.1 Data base element error outputs

The data base elements for the various remote I/O units each have three error outputs:

Table 5-1. Data Base Element Error Outputs

Error Output	Indicates
ERR	An error is present which means that the node cannot be processed.
WARNING	An error is present which means that the node cannot be processed completely.
ERRTYPE	The highest priority error in clear text.

Texts which can be displayed from ERRTYPE:

Table 5-2. Error Texts from ERRTYPE Error Output

Error Output	Indicates
NOT INITIATED	Incorrect BUSNO, IMPL = 0 during system start-up, or system not started.
BUS CONTROLLER ERROR	Bus controller missing or faulty.
COMMUNICATION ERROR	Communication error (node does not respond)
TYPE BAS MISMATCH	I/O unit does not match TYPE BAS.
HARDWARE ERROR	I/O unit has reported a hardware error, for example, a reference channel error
OTHER ERROR	Can occur coincidentally during system start-up.
TYPE EXP FAIL	Expansion unit does not match TYPE EXP.
TRANSDUCER POWER	Error in I/O unit’s transducer power supply.
EXP TRANSDUCER POWER	Error in expansion unit’s transducer power supply.
ERROR CHANNEL A	Error in redundant buss, channel A
ERROR CHANNEL B	Error in redundant buss, channel B

Additional information on the error outputs can be found in the descriptions of the respective data base elements.

5.4.2 System messages

A system message may have the following appearance:

Table 5-3. Example of a system message

1	11	*14:01:32	28	25	CXPC800	H’0000003E	H ‘00B50015	H’00000000
Network	Node	Time	Type	Code	Task	Address	Data1	Data2

The system message can be displayed both during initiation and during operation to indicate that a node which has been created in the data base is not present physically, or to indicate that some other error is present. System messages for MasterFieldbus remote I/O units are always Type=28.

Data 1 in a system message lists concept and instance numbers in hexadecimal form. Corresponding data base elements can be found from this information.

Data 1 = H’00B50015 in the example system message above. When the command MDB 181.21 is given, the data base element for the corresponding node is obtained. (Hexadecimal B5 corresponds to decimal 181, and hexadecimal 15 corresponds to decimal 21).

The following codes are applicable for ABB MasterFieldbus remote I/O units:

Type=28, Code=20: Faulty or missing bus control unit

Type=28, Code=21: The node has reported an error which does not prevent continued execution.

Type=28, Code=25: Communications with the node have been interrupted.

Type=28, Code=26: The node has reported an error which prevents continued execution.

Type=28, Code=39: The node has resumed operation.

5.5 Checklist for Cables, Connections and Terminations

Most errors in the installation of serial communications lines are caused by faulty connections or terminations.

Installation is described in detail in Chapter 3 Installation of MasterFieldbus, but the following is a summary of the most important points to check if the communication is unsatisfactory.

Make sure:

- that all SDB cables are FLFR 3x2x0.34 type, or the equivalent.
- that the SDB cable shields are joined together **at each connection point**.
- that the twisted pairs within the SDB’s do not get confused.
- that the SDB cables are correctly terminated, in accordance with the following:
  - the primary SDB is connected to the bus controller at one endpoint.
  - the other endpoints are terminated by passive terminating unit DSTC 406.

  - each secondary SDB is terminated at the modem end by active terminating unit DSTC 404.
  - the other endpoints are terminated by passive terminating unit DSTC 406.
- that the LDB’s' coaxial cables are connected **directly** to the modems via T connectors, with no intermediate cable between the T connectors and the modems.
- that the outer LDB ends are terminated with 75 ohm terminating plugs.
- that optic fibre cables are not confused.

5.6 Monitoring Communications Quality

The bus controller contains a counter which counts the number of unsuccessful pollings of units on each MasterFieldbus. One can access the counter readings via the Configuration Tool and thereby derive an indication of the communications quality. There is also a counter for each bus, which counts the number of unsuccessful pollings.

Node errors are noted in the Process Station after two consecutive unsuccessful pollings of the same node and thus sporadic errors are not noted. The counter tally, however, increases one step for each unsuccessful polling.

IMPL must be set to ”0” on data base elements for I/O units which are not physically connected; otherwise an error will be registered for each polling of the node. From product release MasterPiece 200/1*2.1 and onwards and for the Advant Controller 400 Series, it is not necessary to reinitiate the system in order for a change in IMPL to be registered.

Evaluate the communications quality as follows:

- Read the counter's value for each bus which is connected to the Process Station by entering the command LMFS (List MasterFieldbus Status) on the Configuration Tool.
- Enter the command LMFS and read the value for each bus one hour later.

A normal communications quality level would be in the order of 10 retransmissions per hour. Retransmissions have absolutely no effect on the transmitted data. However, a high frequency of retransmissions places unnecessary strain on the capacity of the bus, and one is advised to check the installation thoroughly and correct any errors.

The following example shows an unsuccessful polling on bus 2, channel A.

```
#LMFS
MASTERFIELDBUS ERROR COUNTER & COMMUNICATION STATUS      1990-02-22/10:11:59
=========================================
BUS NOSTATUS
---------------------------------------------------------------------------------------------------------
     1          Node No   0    non-functional
     2          Error counter value: 5248          Channel A:       11          Channel B:       9

COMMUNICATION STATUS, TOTAL    T: 1=OK, 0=ERROR, ”BLANK”=NOT IMPLEMENTED
REDUNDANT BUSES, CHANNEL A/B:
                  0     1     2     3     4     5     6     7     8     9    10    11    12    13    14    15
---------------------------------------------------------------------------------------------------------------
Bus No 1:         T     T     T     T     T     T     T     T     T     T     T     T     T     T     T     T
Node 0-15

Bus No 2:       ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT
Node 0-15:      111   111
```

```
#LMFS
MASTERFIELDBUS ERROR COUNTER & COMMUNICATION STATUS      1990-02-22/10:12:15
=========================================
BUS NOSTATUS
---------------------------------------------------------------------------------------------------------------
     1          Node No   0    non-functional
     2          Error counter value: 5249    Channel A:       12          Channel B:       9

COMMUNICATION STATUS, TOTAL     T: 1=OK, 0=ERROR, ”BLANK”=NOT IMPLEMENTED
REDUNDANT BUSES, CHANNEL A/B:
                  0     1     2     3     4     5     6     7     8     9    10    11    12    13    14    15
---------------------------------------------------------------------------------------------------------------
Bus No 1:         T     T     T     T     T     T     T     T     T     T     T     T     T     T     T     T
Node 0-15

Bus No 2:       ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT   ABT
Node 0-15:      111   111
```

Chapter 6 Technical Data of MasterFieldbus

6.1 Bus Controller DSCS 130, DSCS 131, CI570

Figure 6-1. Bus Controller Data for DSCS 130, DSCS 131, CI570

	DSCS 130, DSCS 131	**CI570**
Communication connection	As per EIA 485 with active terminating for SDB. Short-circuit proof, uninsulated. Termination: 120 ohm CMV: Max. ±7 V Signal Coding: NRZI Communication speed HS: 2 Mbit/s Communication speed LS: 375 kbit/s	
Power requirements	Typical: 5 V, 2.0 A Max.: 5 V, 3.0 A	
Environment	Temperature Operating: +5°C to +70°C Temperature Storage: -40°C to +85°C Interference tolerance: As per SS 4361503, class PL3	
Physical specifications	Spacerequirement: 4TE Weight: 0.5 kg	Spacerequirement: One sub-module slot Weight: 0.15 kg
Connection to SDB	X2: RTXR 28-1, 28-pin ABB Combiflex	X4: DB-25S

6.2 Modem and Multiplexer

6.2.1 Modem DSTC 452

Table 6-1. Modem DSTC 452

	DSTC 452		
Electrical data	Data speed:		Switchable between 375 kbit/s and 2 Mbit/s
SDB interface	Signal interface:		As per EIA RS 485, excluding termination
	Signal coding:		NRZI
	Insulation:		None
	Common Mode Voltage (CMV)		Max + 7 V
LDB interface	Signal coding:		FSK (Frequency Shift Modulation) of NRZI data
	Signal frequencies:		6,25 MHz = logical ”1”
	3,75 MHz = logical ”0”		
	Output signal level:	Max:	1 V rms
		Min:	0,5 V rms (measured at coaxial connection with connected coaxial cable)
	Receiver sensitivity:		16 mV rms, measured at coaxial connection
	Insulation:		Via transformer, coupled in parallel with 0.1 µF and 22 Mohm
	Insulation rated voltage:	250 V	
	Insulation test voltage:		1,5 kV, 50 Hz, 1 min
Power supply			110-130 V, 50 Hz 220-240 V, 50 Hz
Physical specifications	Size:		Ca 120 x 230 x 70 mm
	Weight		1.2 kg
Connections	X1:		BNC-chassis connection as per MIL-C-39012 (IEC 169-8)
	X11:		3-pole plug-in terminal, 7.62 mm separation
	X12:		10-pole plug-in terminal, 5.08 mm separation
Environment	Enviromental class:		MY1
	Interference tolerance:		As per SS 4361503 class PL3
	Enclosure class:		IP 20 as per IEC 529
	ESD tolerance:		As per SS 4361522 class PE3
	Flammability of cover:		as per UL 94V-0
	Temperature range:	Operating:	+5°C - +55°C
		In storage:	-40°C - +85°C

6.2.2 Modem DSTC 454 and DSTC 454L

Table 6-2. Modem DSTC 454/454L

<table>
<tr><th></th><th>DSTC 454</th><th>DSTC 454L</th></tr>
<tr><td>Electrical data</td><td>Data speed: 2 Mbit/s</td><td>375 kbit/s</td></tr>
<tr><td>SDB interface</td><td colspan="2">Signal interface: As per EIA RS 485, excluding termination
Signal coding: NRZI
Insulation: None
Common Mode Voltage (CMV) Max ± 7 V</td></tr>
<tr><td>LDB interface</td><td colspan="2">Signal coding: Bits (mark)
The minimum transmitted mean power in fibre of different dimensions (strapper group S2 located for full power):

50 µm -17 dBm with NA ≥ 0.20
62.5 µm -13 dBm with NA ≥ 0.24
85 µm -12 dBm with NA ≥ 0.24
100 µm -10 dBm with NA ≥ 0.26

Typical and maximal values for the mean power are 3 and 6 dB respectively over these values.

S2 located for ”reduced power” gives a reduction -8 dB compared to full power.

Receiver dynamics: -34 dBm < Pin< -11 dBm for BER<10^{-9} where Pin is the mean power received.</td></tr>
<tr><td>Power supply</td><td colspan="2">110-130 V, 50 Hz
220-240 V, 50 Hz</td></tr>
<tr><td>Physical specifications</td><td colspan="2">Size: Ca 120 x 230 x 70 mm
Weight 1.2 kg</td></tr>
<tr><td>Connections</td><td colspan="2">X1, X2: Optical connector type F-SMA
X11: 3-pole plug-in terminal, 7.62 mm separation
X12: 10-pole plug-in terminal, 5.08 mm separation</td></tr>
<tr><td>Environment</td><td colspan="2">Environmental class: MY1
Interference tolerance: As per SS 4361503 class PL3
Enclosure class: IP 20 as per IEC 529
ESD tolerance: As per SS 4361522 class PE3
Flammability of cover: as per UL 94V-0
Temperature range: Operating +5°C - +55°C
In storage -40°C - +85°C</td></tr>
</table>

6.2.3 Multiplexer 456

Table 6-3. Multiplexer 456

Elektrical data	Data speed:	375 kbit/s or 2 Mbit/s
SDB interface	Signal interface: Signal coding: Insulation: Common Mode Voltage (CMV)	As per EIA RS 485 exkluding termination NRZI None Max ± 7 V
Power supply		a.c. 47-63 Hz 120 V, +10%, -15% 230 V, +15%, -20%
Physical specifications	Size: Weight	Ca 120 x 230 x 70 mm 1,2 kg
Connections	X1, X2: X11: X12:	8-pole plug-in terminal, 5.08 mm separation 3-pole plug-in terminal, 7.62 mm separation 10-pole plug-in terminal, 5.08 mm separation
Environment	Environmental class: Interference tolerance: Enclosure class: ESD tolerance: Flammability of cover: Temperature range:	MY1 As per SS 4361503 class PL3 IP 20 as per IEC 529 as per SS 4361522 class PE3 as per UL 94V-0 Operating +5°C - +55°C In storage -40°C - +85°C

6.3 Terminating units DSTC 404 and 406

Table 6-4. Terminating Units DSTC 404 and DSTC 406

Signal interface	As per EIA RS-485. Characteristic impedance: 120 ohms for SDB.	
Physical specifications	Dimensions:	DSTC 40440 x 35 mm DSTC 40630 x 35 mm
	Weight:	ca 25 g
Connections	DSTC 404:	8 pins for connection together with wire (maximum 0.5 mm^2) to plug-in terminal with 5.08 mm separation.
	DSTC 406:	6 pins for connection together with wire (maximum 0.5 mm^2) to plug-in terminal with 5.08 mm separation.
Environment	Interference tolerance:	As per SS 4351503 class PL3
	Temperature range:	Operating+5°C - +55°C In storage-40°C - +85°C

6.4 Surge Arrester DSTC 451

Table 6-5. Surge Arrester DSTC 451

Application	Protectional against voltage surges in unbalanced 75 ohm coaxial cable.	
Maximum signal level	10 V$_{rms}$	
Gas discharge tube	Striking voltage	280 - 800 V
Connections	Coaxial cable	BNC, female jack (in and out)
	Grounding connection	M6-screw or by mountingon a grounded surface
Dimensions	110 x 115 x 55 mm	

6.5 SDB-cable

Table 6-6. SDB Cable

Cable type	Telecommunications signal conductor type FLFR-A, 3x2x0.34 mm2 or equiv.
Cable pairs	Twisted, at least 20 windings per m.
Insulation	Polyethylene

Table 6-6. SDB Cable

Shielding	Tinned copper. Minimum density 90 %.
Capacitance	Direct Max 55 nF/km Conductor-shielded Max 80 nF at 1kHz Max. unbalance to shielding 2,5 nF/km Max. unbalance between pairs 700 pF/km
Damping	Max. 6 dB/km at 100 kHz Max. 27 dB/km at 2 MHz
Characteristic impedance	110-140 ohm at 100 kHz 110-130 ohm at 2 MHz
Rise time	Max 1 µs/100 m for cable terminated with 120 ohm
Length	Max 25 m.

6.6 LDB Cable

6.6.1 Electrical LDB-cable

Table 6-7. Electrical LDB Cable

Cable type	Different types of coaxial cable may be used. LDB’s tolerance against electrical interference depends on the working signals’ amplitude and, consequently, on the cable’s shielding and damping characteristics.		
Maximum length	Interference class PL3	RG-59	400 m
		RG-11	750 m
	Interference class PL2	RG-59	600 m
		RG-11	1150 m

6.6.2 Optical LDB-cable

Table 6-8. Optical LDB Cable

Suitable cable type	ABB Cable type no: GNHKD 2 x L 50/125 for installation on cable ladders (industrial environment) GNHGKDV 2 x L 50/125 for underground installation GNBTLV 2 x L 50/125 marine cable GNHCLD 2 x L 50/125 suspended cable GNKD 2 x L 50/125 apparatus cable (office environment) For ordering other fiber dimensions replace 50/125 with the required dimension, i.e. 62,5/125, 85/125 or 100/140.
Max length	Calculated in accordance with the instructions in section 2.6 ”Power budget for optical LDB”.
Max permitted attenuation in cable	50/125 µm 17 dB 62,5/125 µm 21 dB 85/125 µm 22 dB 100/140 µm 24 dB

6.7 Order Numbers

Table 6-9. Order Numbers

DSCS 130(1)	5731 0001-FH
DSCS 130(1) with cableDSTK 127 and connection unit DSTC 408	5730 030-LA
DSCS 131	5731 0001-LM
DSCS 131 with cable DSTK 127 and connections unit DSTC 408	5730 032-BK
DSCS 131 with cable DSTK 132L2.5 and two connection units DSTC 408	5730 032-BL
CI570 with cable TK570V01 and connection unit TC570	3BSE 006 060
Cable TK570V01 (length 1.8 m)	3BSE 003 254
Modem DSTC 542	5730 030-LB
Modem DSTC 454	5751 017-F
Modem DSTC 454L	5751 017-R
Multiplexer DSTC 456	5751 017-L
Terminating unit	DSTC 4045752 0001-DS DSTC 4065752 0001-DX
Cable FLFR 3x2x0,34	(Sold by the meter) 1687 0032-2
Connection link for SDB	2638 147-2
Coaxial cable RG 59	1689 0016-1
Coaxial cable RG 11	1689 0033-1
BNC connector for RG 59	5217 423-8
BNC connector for RG 11	5217 423-15
BNC-T-connector	5217 423-13 (Part of DSTC 452)
BNC terminating plug; 75 ohm	5217 423-14
Surge arrester DSTC 451	5685 2000-A

(1) DSCS 130 is replaced by DSCS 131

6.8 Dimension drawing

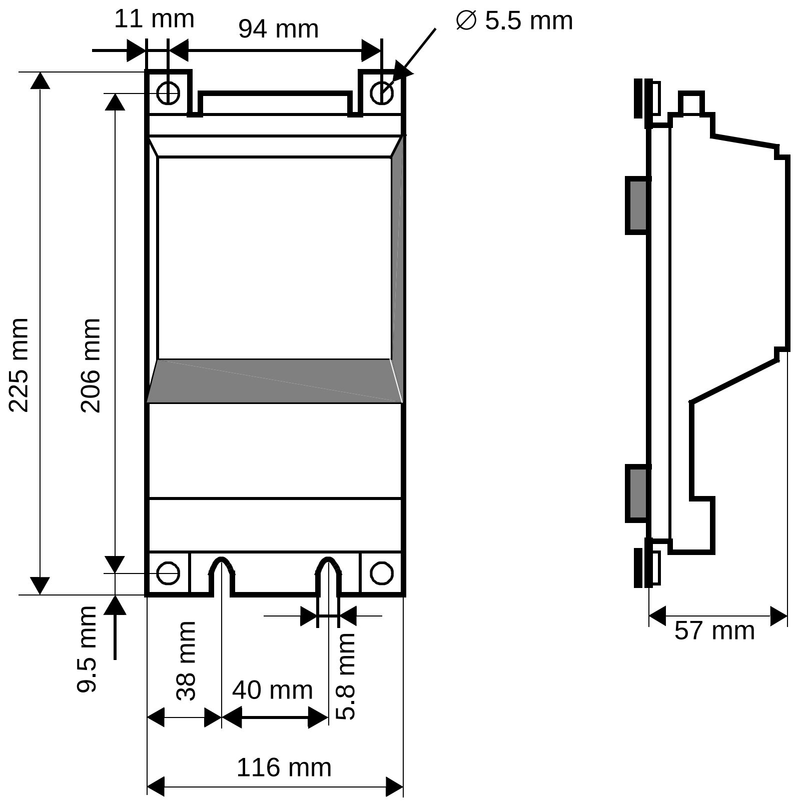


Figure 6-2. Dimension Drawing Modem

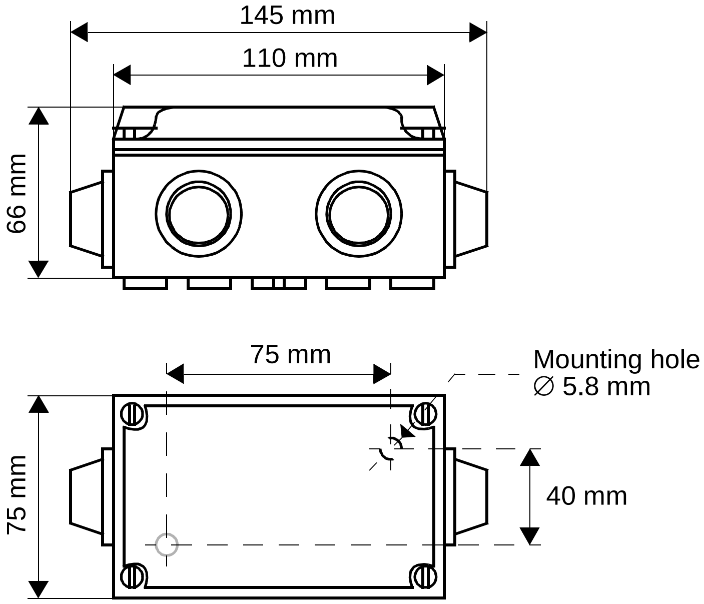


Figure 6-3. Surge Arrester

Chapter 7 Introduction to S400 I/O Units

7.1 General

The S400 I/O Units makes it possible to distribute the system's inputs and outputs to distances of up to 750 m from the Process Station. The Process Station and the various I/O units communicate via the ABB MasterFieldbus serial bus which was described in Part A of this handbook. Independent process station MasterPiece 51 can also be connected to the MasterFieldbus. This station then functions as an intelligent I/O unit capable of taking over certain portions of the process control itself.

The laying of cable represents a major part of the costs involved in such a system. For this reason it is obviously advantageous to be able to transmit a large number of signals serially between the Process Station and one I/O unit and to have separate signal wires only between the I/O unit and the process. The more spread out the process, the greater the advantages offered by Distributed I/O.

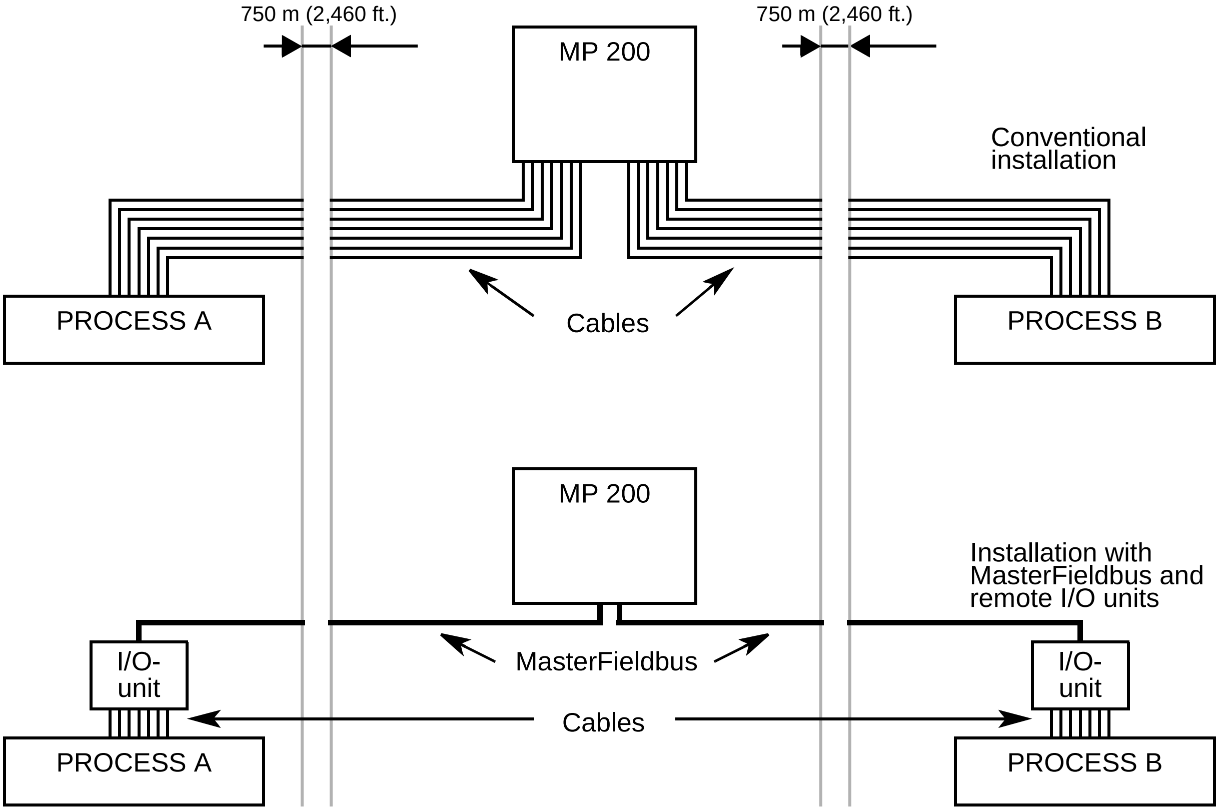


Figure 7-1. Cable-laying with and without ABB MasterFieldbus and S400 I/O Units.

Chapter 8 Technical Description of S400 I/O Units

8.1 General

All of the I/O units have the same mechanical design and differ only with regard to their indicators and with regard to the type, number and grouping of their inputs and outputs. These differences between the various units are described in Chapter 12 S400 I/O Units (except MasterPiece 51).The Technical data in this chapter also apply to MasterPiece 51, unless otherwise indicated.

Each unit is housed in a cast aluminium chassis. The circuit board is screwed permanently to the chassis and uses it as a heat sink.

The chassis and the electronics are covered by a plastic cover which may be removed only by a qualified service technician.

Above the cover there is a lid which covers the accessible parts of the electronics, including the address switches.

All of the inputs and outputs have two-wire connectors and require no additional terminal units.

8.2 Digital inputs

As a group, the digital inputs are galvanically isolated from the rest of the system by means of optocouplers.

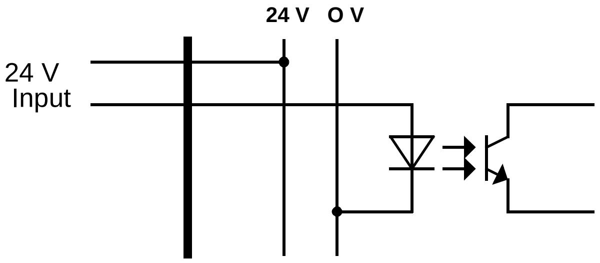


Figure 8-1. Digital Inputs

The I/O unit supplies a voltage of 24 V for transducer power supply. This is accessible on a separate terminal at each input. The power supply’s neutral and chassis ground are accessible at terminal X21 (outputs marked ”U” and ”G” respectively.)

The placements of the input and the transducer power supply fuses in the various I/O units are presented in the pictures in Chapter 12 S400 I/O Units (except MasterPiece 51).

8.3 Digital outputs

The digital outputs have relays with make contacts. Each output is galvanically isolated from the rest of the system and has an RC-link to damp overvoltages which arise when the current to inductive loads is broken

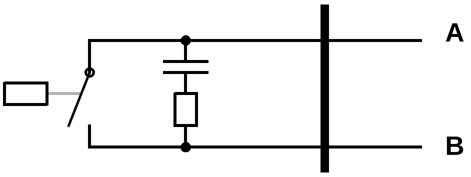


Figure 8-2. Digital Outputs

The placements of the outputs in the various I/O units are presented in the pictures in Chapter 12 S400 I/O Units (except MasterPiece 51).

The relays used for these outputs require a certain minimum load to operate reliably, as do most other relays. See the section titled ”Technical Data”.

It is not advisable to feed a control system input, which typically draws 10 mA of current, through a relay contact. In such a case, the load should be shunted to ensure reliable contact operation. See technical data.

Units intended for low level signals can be used as an alternative. These units have an L in their type designations. (e.g. DSDX 452L). Note that these outputs may never be loaded beyond their specified maximum load as they then lose their capacity to transmit low level signals.

8.4 Analog inputs

The analog inputs are bipolar and can each be jumpered separately for voltage signals (0 - ±10 V) or current signals (0 - ±20 mA), and for differential or direct-grounded signals. The manner in which the signal will be interpreted is determined in the data base element in the Process Station for each channel; for example, a signal may be interpreted as 4-20 mA. An integrating A/D converter handles the conversion of all of the inputs, including reference channels. The interval between two conversions is determined by (n + 1)* 50 ms, where ”n” is the number of channels which are implemented in the data base. The 24 V transducer supply voltage is accessible via a separate terminal.

The placements of the inputs in the DSAX 452 analog I/O unit are shown in Figure 12-5. Jumpering of the inputs is described in Section 9.4.3 Analog input signals.

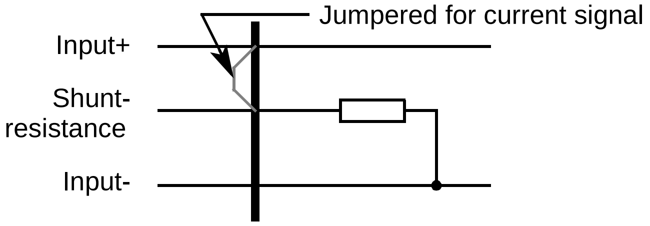


Figure 8-3. Analog Inputs

8.5 Analog outputs

The analog outputs are unipolar and deliver an output signal of 0 - 10 V or 0 - 20 mA depending on which terminal the load is connected to.

The voltage output must not be loaded with a resistance lower than 2,000 ohm.

With regard to the current output, the internal power supply can drive 20 mA in connection with load resistances of up to 750 ohms. Loads of up to 1,000 ohms can be connected if an external power supply is used. The placements of the outputs in DSAX 452 are shown in Figure 12-5.

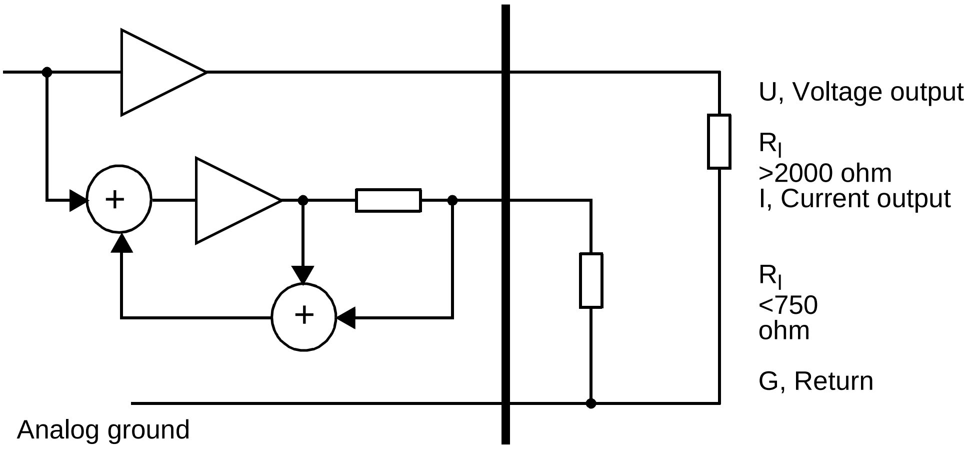


Figure 8-4. Analog Outputs

8.6 Indicators

The various I/O units, expansion units and MasterPiece 51 have different indicators on their tops. The following Table 8-1 shows the meanings of the various LEDs for each unit.

Table 8-1. Indicators on Remote I/O Units, Expansion Units and MasterPiece 51

The 32 LED’s in the middle of the cover		All units except DSAX 452	Indicates status of input and output channels
PW (Power)	Steady glow	All units	Mains supply OK
TP (Transducer Power)	Steady glow	All units	Transducer power supply OK
RUN	Off when PW glows	All units	Unit not functioning
RUN	Flashing	Remote I/O units	Unit has started up after power was switched on and has performed internal self-testing. No parameters or data have been transmitted from superordinate system.
		MasterPiece 51	Unit has started up after power was switched on and has performed internal self-testing. No local application programs run.
		Expansion units	Unit has started up after power was switched on and has performed internal self-testing. No parameters or data have been transmitted from superordinate system.
RUN	Steady glow	Remote I/O units	Parameters transmitted from superordinate system - communication established.
		MasterPiece 51	Local application program run (possible contact with superordinate system not indicated)
		Expansion units	Parameters transmitted from superordinate system - communication established.
BATT	Steady glow	MasterPiece 51 only	Memory backup battery OK.
C	Flashing	Only DSAX 452	A/D-converter in operation.

Chapter 9 Installation of S400 I/O Units

9.1 Mounting

The remote I/O units can be mounted directly on the wall, on mounting plates or on two DIN rails. In most cases some form of enclosure is necessary in order to satisfy environmental requirements (see Chapter 14 Technical Data of S400 I/O Units). Any expansion units used should be located as close to the basic unit as possible. The maximum allowable distance between basic and expansion units is 40 mm. An expansion unit and the basic unit must be connected to the same ground. This can be achieved by mounting the units on a mutually conductive base, such as a mounting plate or DIN rails. If the underlying base is not conductive then ground connectors must be attached to the lower edges of each unit. These ground wires must be at least 10 mm^2 in area. See Figure 3-15.

The units should always be fitted along a vertical plane, as shown in the figures of this section. Otherwise, the cooling may be jeopardized.

The unit may be rotated by 90 degrees in the vertical plane. If so, the maximum permissible ambient temperature must be reduced by 10° C.

9.1.1 Mounting on wall or on mounting plate

Make holes as per Figure 9-1. The distance between the basic unit and the expansion unit will then be roughly 2 mm (0.1”).

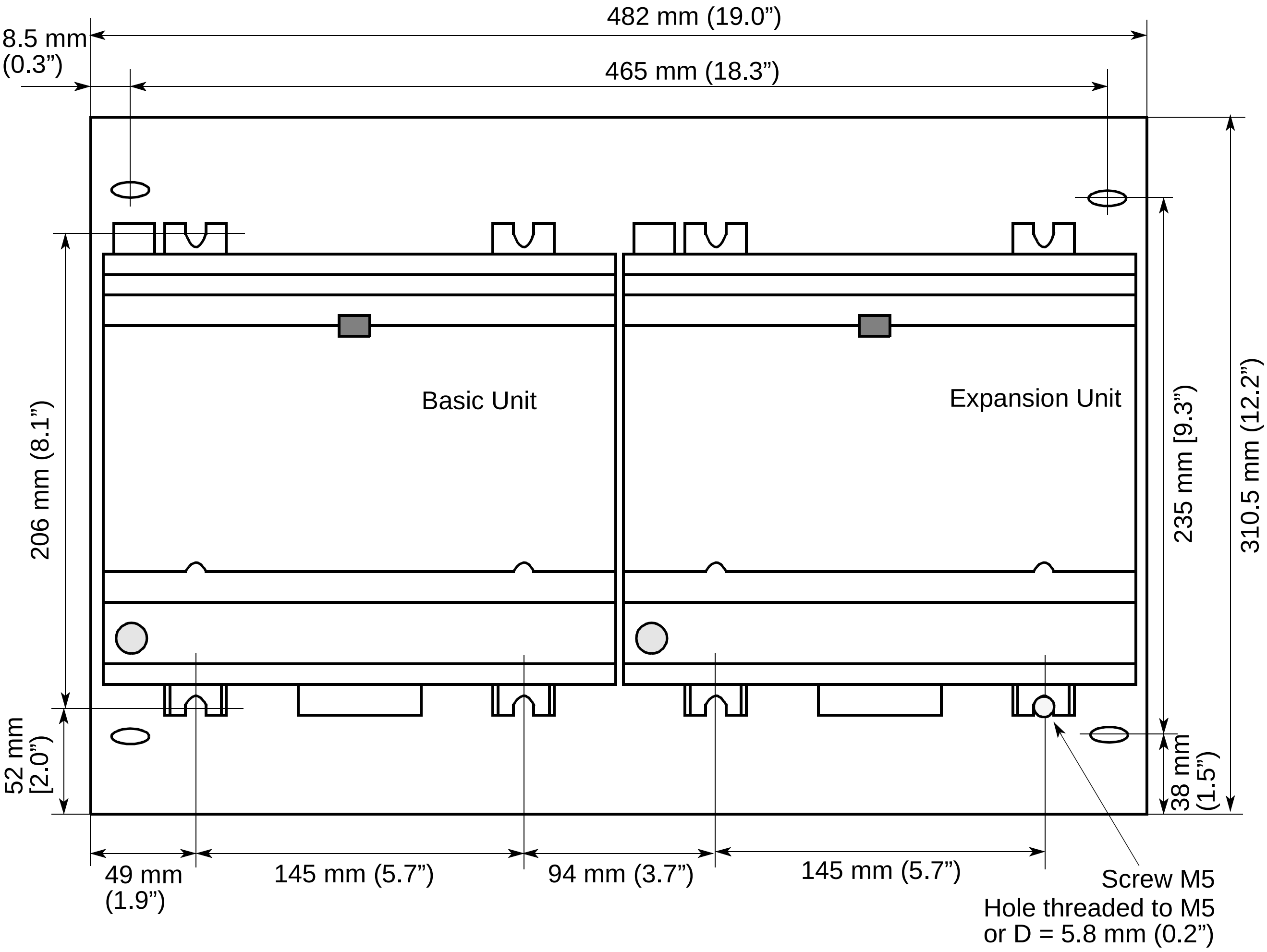


Figure 9-1. Mounting on wall or on mounting plate

9.1.2 Mounting on DIN rails

Use top rails as per EN50022-35x7.5 with a center spacing of 133.35 mm (5.25”). See Figure 9-2.

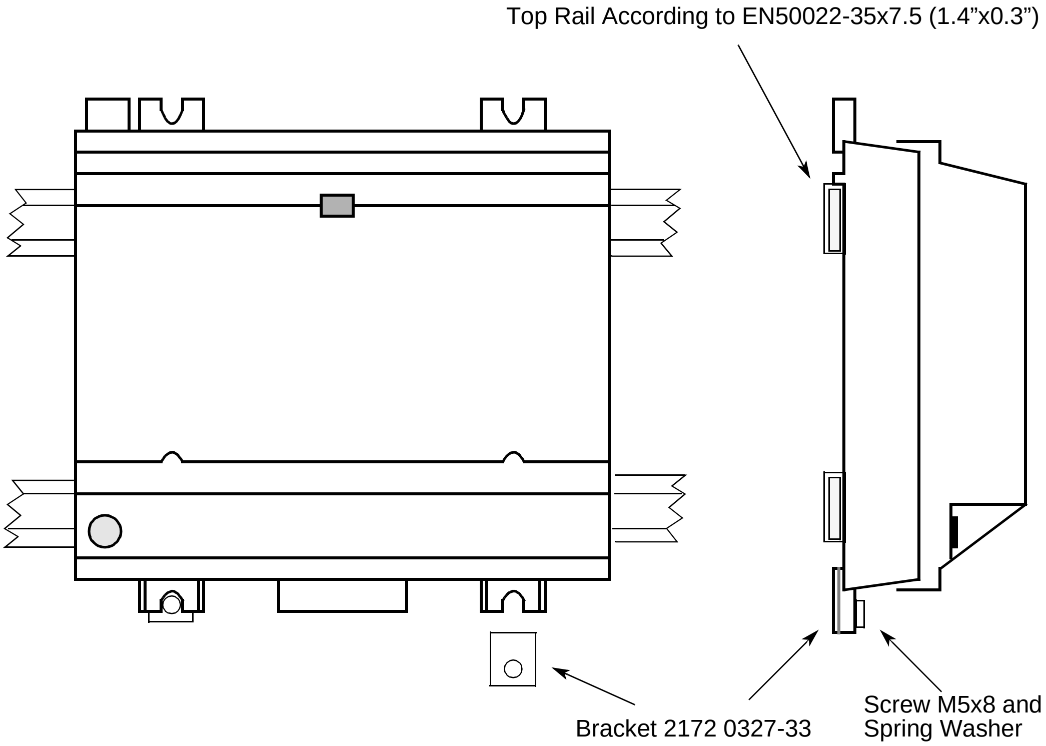

Top Rail According to EN50022-35x7.5 (1.4”x0.3”)
Bracket 2172 0327-33
Screw M5x8 and Spring Washer

Figure 9-2. Mounting on DIN rails

9.2 Power supply

The various remote I/O units and expansion units should be separately and permanently connected to the power supply. Connect the cable to basic and the expansion units to plug-in terminal X11 as follows (see Figure 9-3):

- Connect the fuse-protected phase conductor to X11:4
- Connect the neutral conductor to:
  - X 11:3 if the line voltage is 120 V
  - X 11:2 if the line voltage is 220 V (see note)
  - X 11:1 if the line voltage is 240 V (see note)
- Connect the yellow/green protective ground wire to the ground screw.

NOTE

The standard 230 V line voltage should preferably be connected to the 240 V terminal. However, if the network is weak and seldom gets close to its upper voltage limit (230 V ±10%), the 220 V terminal should be used.

For safety reasons, the units are only allowed to be connected to a mains network where the neutral conductor is available and tied to the protective earth at the distribution panel. If this is not the case, an intermediate transformer is required.

NOTE

All units which are connected to the same SDB must be connected in an electrically stable manner and grounded together. See Section 3.5 Grounding of SDB.

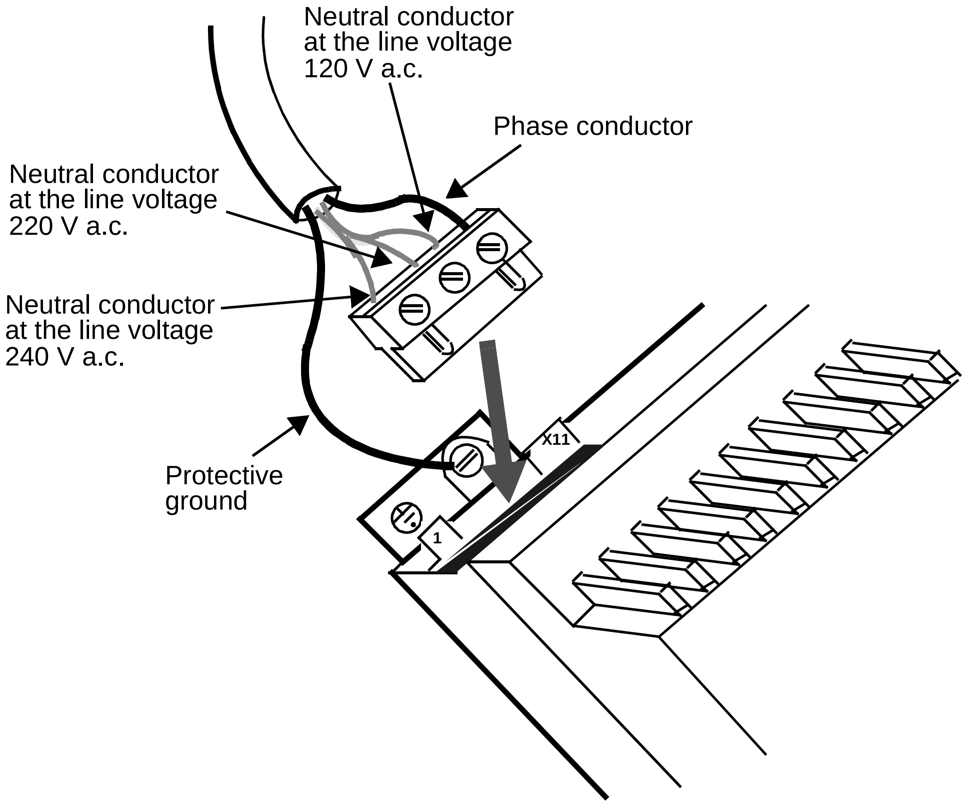

Neutral conductor at the line voltage 120 V a.c.
Phase conductor
Neutral conductor at the line voltage 220 V a.c.
Neutral conductor at the line voltage 240 V a.c.
Protective ground
X11
1

Figure 9-3. Connection of Power Supply

9.3 Connection of expansion unit to basic unit

If an expansion unit is added to a remote I/O unit or MasterPiece 51 it must be connected to the basic unit **before** power is supplied to the units.

Connect the units together using the flat cable which is mounted below the expansion unit’s lid (see Figure 9-4). This cable may not be extended. Excess cable can be pushed back under the expansion unit lid.

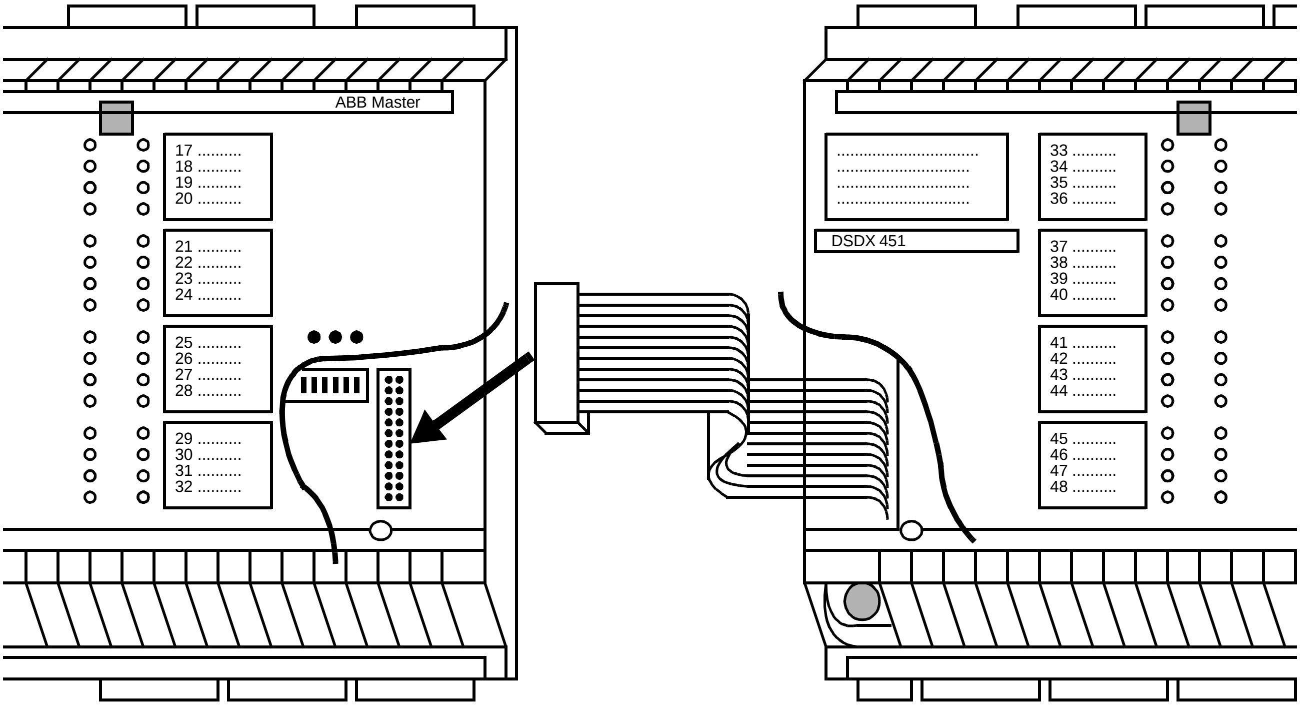


Figure 9-4. Connection of Expansion Unit to Basic Unit

9.4 Process signals

9.4.1 Digital input signals

All inputs have two terminals. The terminal marked ”I” is intended for the input signal itself, while the terminal board marked ”U” gives access to the I/O unit's 24 V internal transducer power supply.

The placements of the inputs are included in the respective descriptions of the units in Chapter 12 S400 I/O Units (except MasterPiece 51).

Terminal group X21 gives access to the transducer power supply's common neutral and to chassis ground.

Connect the transducers as per Figure 9-5.

When internal transducer power supply is used, be careful not to exceed the unit's maximum current draw according to Section 14.3.2 Transducer power supply.

NOTE

The TP LED on the I/O unit does **not** indicate the loss of external transducer power.

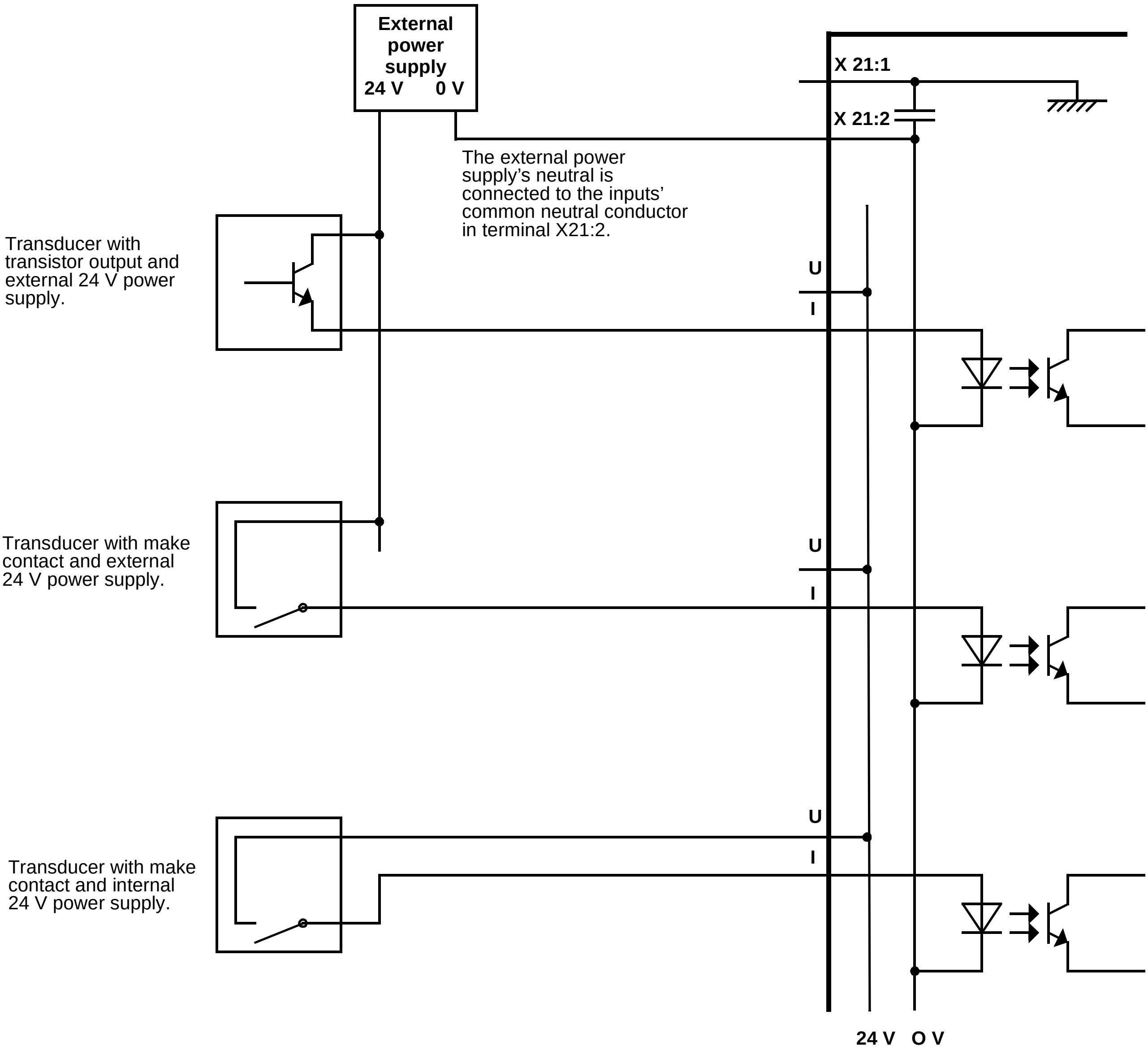

External power supply
24 V
0 V
X 21:1
X 21:2
The external power supply's neutral is connected to the inputs' common neutral conductor in terminal X21:2.
Transducer with transistor output and external 24 V power supply.
Transducer with make contact and external 24 V power supply.
Transducer with make contact and internal 24 V power supply.
U
I
U
I
U
I
24 V
O V

Figure 9-5. Various Examples of Transducer Connections

9.4.2 Digital output signals

All of the outputs have make relay contacts.

The locations of the outputs on the respective I/O units are presented in Chapter 12 S400 I/O Units (except MasterPiece 51).

Connect the loads as per Figure 9-6.

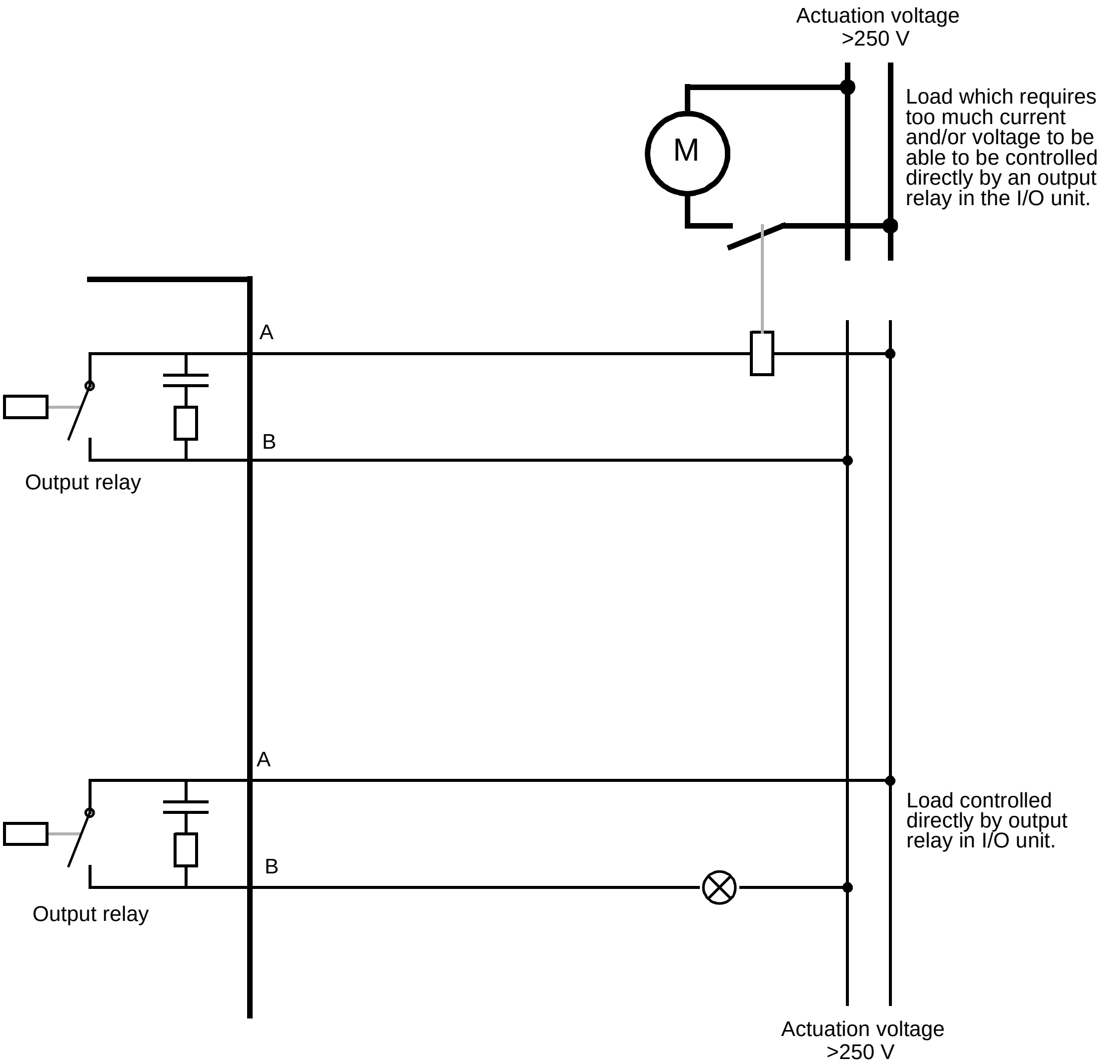

Actuation voltage
>250 V
M
Load which requires too much current and/or voltage to be able to be controlled directly by an output relay in the I/O unit.
A
B
Output relay
A
Load controlled directly by output relay in I/O unit.
B
Output relay
Actuation voltage
>250 V

Figure 9-6. Various Examples of Load Connections

9.4.3 Analog input signals

Each analog input has three terminal boards, marked ”**+**”, ”**I+**” and ”**-**”.

The inputs are grouped two by two in 7 separate terminal groups. The locations of the inputs on DSAX 452 are presented in Figure 12-5.

The transducers can be powered either from the internal transducer power supply (24 V), which is accessible at a separate terminal, or from an external source.

The connection of two-wire transducers for current is depicted in the upper portion of Figure 9-7. The connection of differential signals for current is depicted in the lower portion of the figure.

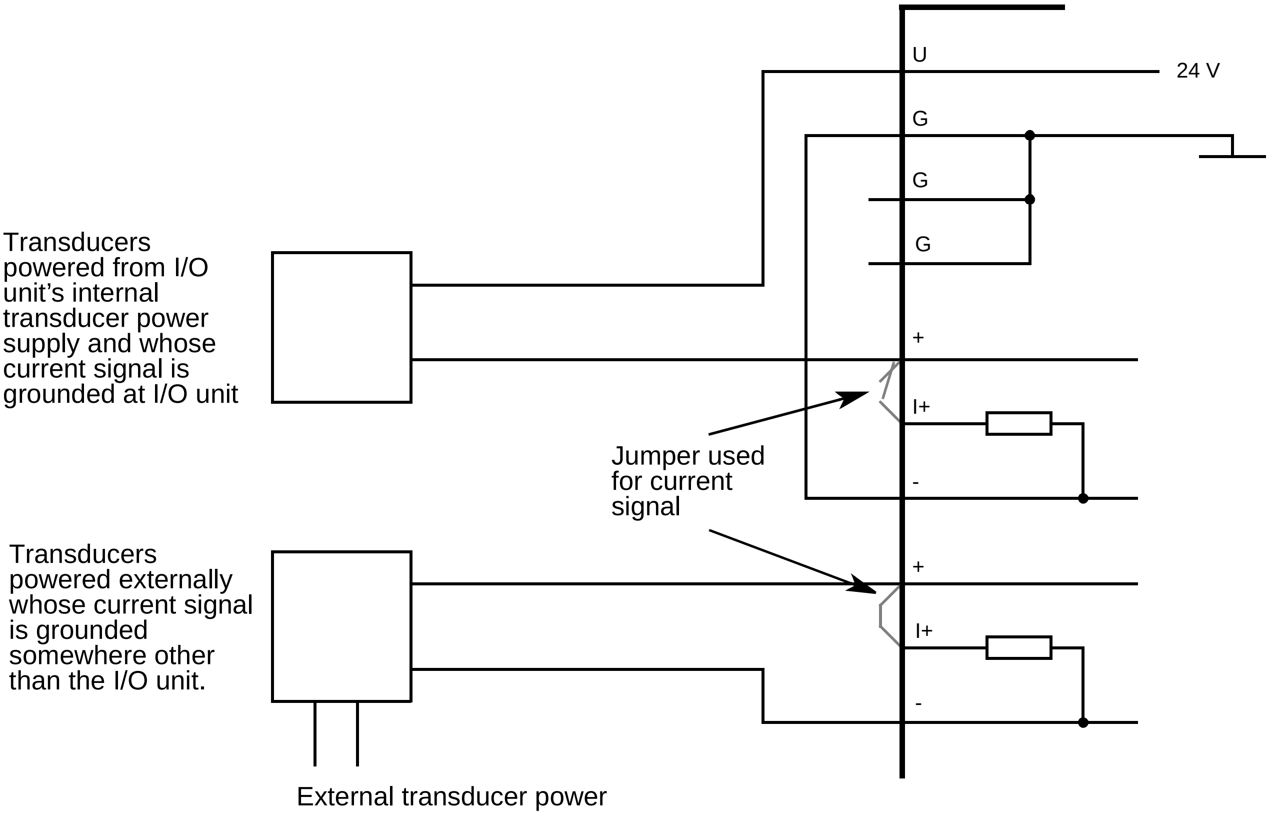

U
24 V
G
G
G
Transducers powered from I/O unit’s internal transducer power supply and whose current signal is grounded at I/O unit
+
I+
-
Jumper used for current signal
Transducers powered externally whose current signal is grounded somewhere other than the I/O unit.
+
I+
-
External transducer power

Figure 9-7. Connection of Analog Transducers

The jumper determines whether the input is wired for current or voltage. Mounted jumper = current input. The jumper is mounted along with the signal conductors in the detachable section of the terminal.

The transducers for 0 - 20 mA and for 4 - 20 mA are connected in the same way. Signal type and range are defined individually in the data base element for each channel. This information is transmitted to the I/O unit at each restart. The I/O unit handles offset and scaling by itself.

9.4.4 Analog output signals

Each analog output has three terminals, marked ”**I**”, ”**U**” and ”**G**”.

The outputs are grouped two by two in 3 separate terminal board groups. The locations of the outputs on the analog I/O unit DSAX 452 are shown in Figure 12-5.

One load terminal is connected to either the current or voltage output, while the other is connected to the grounding terminal.

Connect the loads as per Figure 9-8.

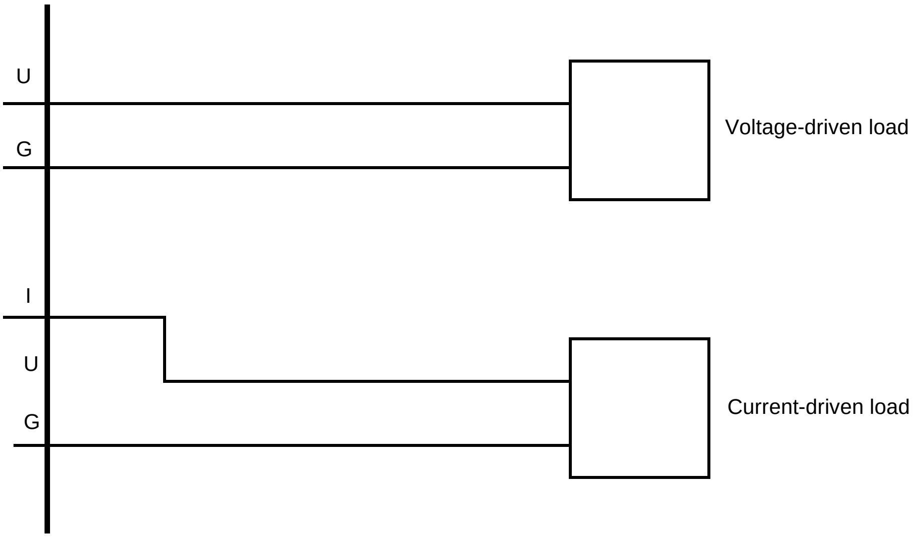


Figure 9-8. Connection of Loads to Analog Outputs

The loads can be powered either from the I/O units themselves or via the I/O units from a separate power supply. Connect the power supply to terminal board X12 as per Figure 9-9 or Figure 9-10 in either case.

In case of external power supply, the following points must be observed:

- The supply will be grounded in the DSAX 452 unit
- If other loads are connected to this supply, an interrupted line (e.g. blown fuse) can expose the supply input of DSAX 452 to an impermissible amount of energy. A separate circuit (separate fuses and circuit breakers) for analog supply should thus be arranged.

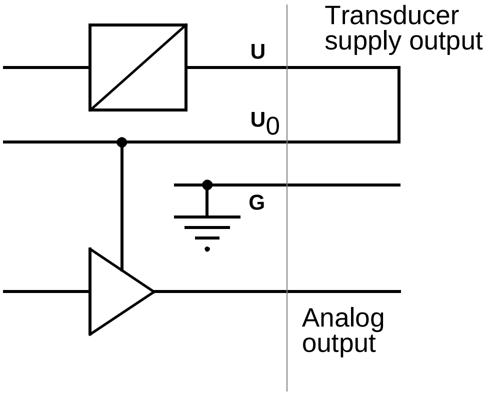


Figure 9-9. Connection of Internal Power Supply to an Analog Output

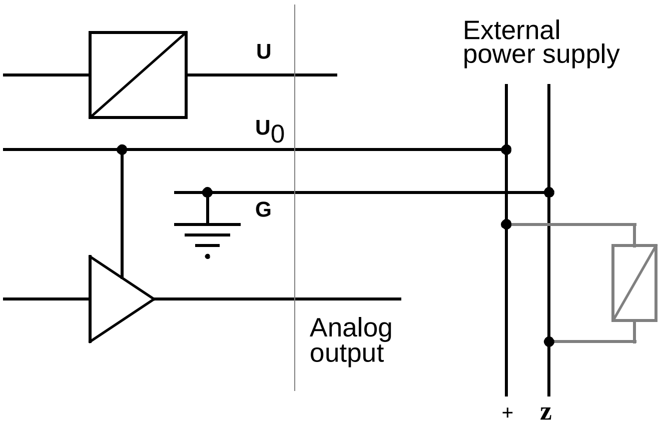


Figure 9-10. Connection of External Power Supply to an Analog Output

9.4.5 External signal conditioning

When signal voltages other than those the I/O boards are designed for are used, these signals have to be matched to the system externally. Some suppliers of terminals and connectors offer suitable equipment for this purpose.

For the signal voltages 24 V, 120 and 230 V, the connection units DSTD W110, DSTD W120 and DSTD W130 are suitable. See Table 9-1 below:

Table 9-1. Connection Units for 120V a.c. and 230 V a.c.

Designation	Rated voltage	No. of Channels
DSTD W110	24 V d.c./a.c. galvanic isolated	8
DSTD W120	120 V a.c.,d.c./24 V	8
DSTD W130	230 V a.c./24 V	8

For more technical data, see the technical description of MasterPiece 200/1.

The channels of the connection units are individually isolated on the process side. On the 24 V side, which is connected to the channels of the I/O boards, all channels have a common, grounded return line.

The connection units are fitted to 19” racks or into cabinets as usual, using aluminium profiles, 120 mm wide. See the ordering instructions.

Four connection units (width = 120 mm) can be accommodated on one 19” mounting profile.

The connection units and I/O units are interconnected as shown on the diagram overleaf, Figure 9-12. Only the X82 connector on the connection unit is utilized.

The connection of **U-** on X21:2 on the I/O unit is important. Note that it becomes grounded on the connection unit. In practice, this means that the channels of the I/O unit no longer will be galvanically separated from earth. This may be important if 24 V signals from the plant are connected to the same I/O unit.

The diagram should be seen as a principal solution. The channels of the I/O unit may be connected to the connection units in any order. If channels destined for two I/O units, (e.g. a basic unit and an expansion unit) are connected to the same connection unit, it is essential that the **U-** terminals (X21:2) of both units are interconnected. The maximum load on the sensor supply circuit of the unit must also be checked. The configuration shown in Figure 9-11 below is permissible. The power supply (**U+**) to the divided connection unit should be taken from the expansion unit.

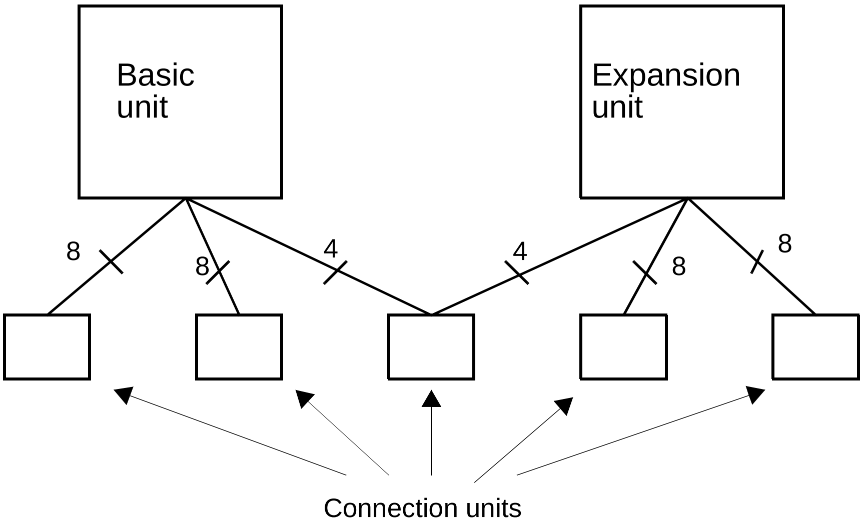


Figure 9-11. Permissible Configuration

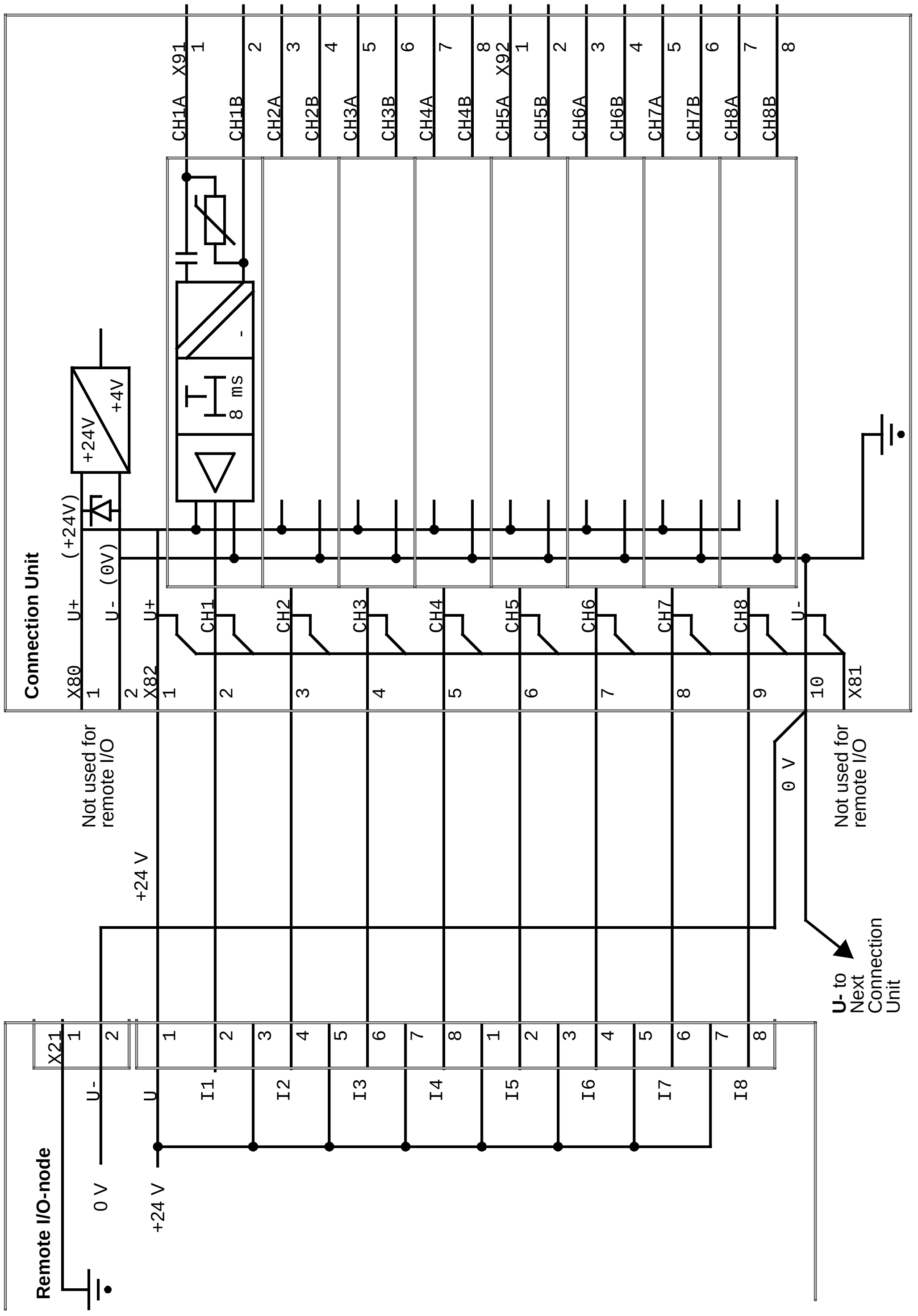


Figure 9-12. Interconnection of Connection Unit and I/O unit

9.5 Connection of ABB MasterFieldbus

Connect the MasterFieldbus SDB to the plug-in terminal’s detachable section in the manner described in Section 3.4 Connection of bus network. Plug the detachable section into the corresponding jack on the I/O unit (connection X16).

9.6 Cable installation

The remote I/O units tolerate cable interference as per SS 436 1503, class PL3.

The following points apply with regard to cables to and from I/O units:

- There are no restrictions concerning distances between I/O cables.
- Do not mix signal conductors and conductors with AC loads in the same cable.
- The return conductor should always be in the same cable as the signal conductor.
- Power supply wires should be kept in a separate cable.
- Unshielded cables may be used for digital signals.
- Analog signals must travel along sparsely shielded cables, **grounded in the same end of the cable as the signal is**, i.e., at the transducer in the case of AI signals and at the I/O unit in the case of AO signals.
- The communication cable for ABB MasterFieldbus must be installed at least 50 mm (2”) from other cabling. See also Section 3.2 Cable Installation.

Furthermore, **all** cables to and from I/O units must be installed at least 100 mm (4”) from power cables whose phase voltage is higher than 250 V. See Figure 3-1.

If a remote unit and possible expansion unit are installed together with relay equipment from which interference has not been eliminated, minimum distances must be maintained between, on the one hand, the remote unit and the expansion unit and, on the other hand, contactors and load cables, as shown in Figure 9-13.

If nonsuppressed cables to the relays' loads must pass through the shaded area in the drawing, they may not be placed farther than 50 mm from the surface on which the units are mounted.

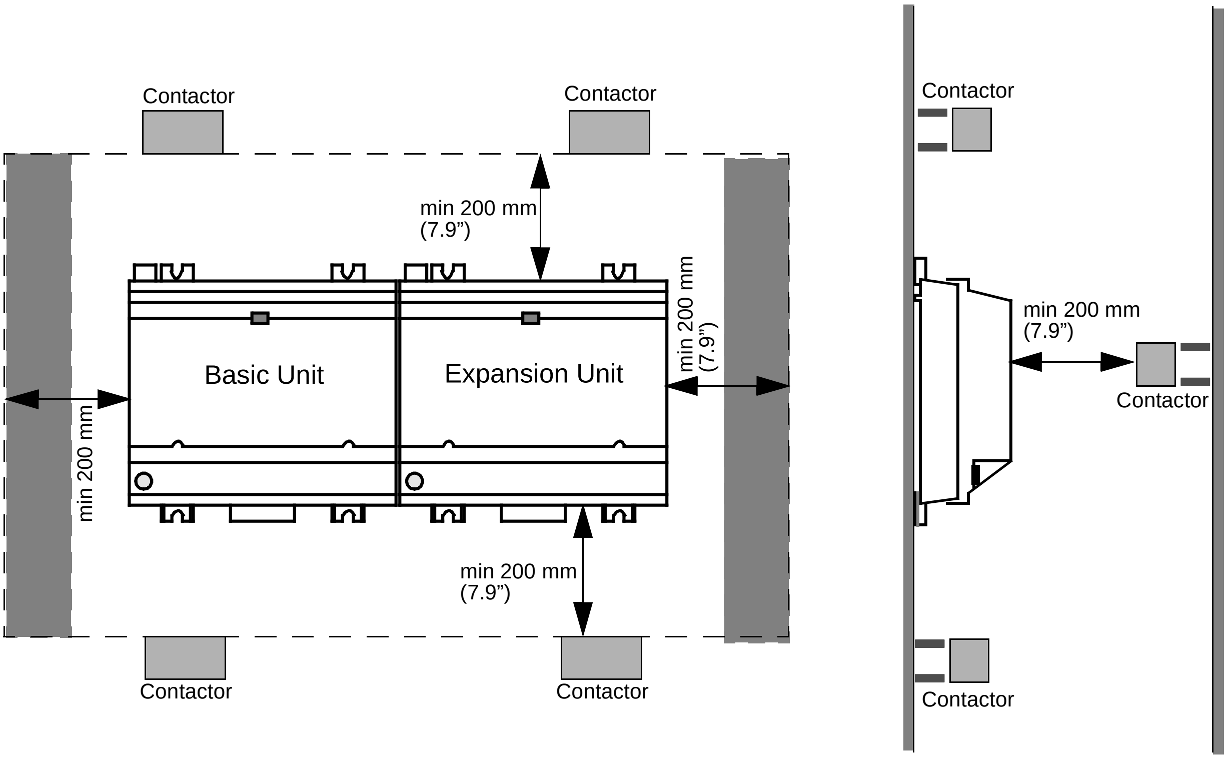


Figure 9-13. Minimum Distance between Remote I/O Units and Contactors

Chapter 10 Data Base Configuration of S400 I/O Units

10.1 General

The remote I/O units' inputs and outputs (**not MasterPiece 51**) are connected within the PC program in a manner which corresponds to the inputs and outputs of the I/O board in the main rack. The dimensioning of the data base and the data base elements for the remote I/O units are described in the following sections. Figure 10-1 presents an overview of the information flow between the PC program, the data base and the remote I/O units. In Section 10.3 Signal processing the signal paths to and from the I/O-units are briefly described.

MasterPiece 51 is also configured with a data base element, but its inputs and outputs to the Process Station are not connected to the data base element, but rather directly to a special PC element in the PC program. This element is described in Section 10.5.3 MasterPiece 51 (basic unit DSPX 452).

10.2 Initiation and monitoring

When the Process Station is initiated it transmits parameters to the I/O units in accordance with the information in the data base. In this way the system makes sure that the same types of units are on-line physically as are configured in the data base. The same process occurs within 15 seconds after any change in a data base element or after communications have been restored following a shutdown.

10.3 Signal processing

10.3.1 Digital inputs

The digital input signals are filtered in the I/O unit and sent to the bus controller via MasterFieldbus. The frequency with which the data base is to be updated with values from the bus controller for each channel is defined in the data base.

10.3.2 Analog inputs

The analog input signals are filtered, checked for variations and scaled to process-related units in the I/O unit, on the basis of the parameters which have been defined in the data base. Thereafter the information is transmitted via MasterFieldbus to the bus controller. The frequency with which the data base is to be updated with values from the bus controller for each channel is defined in the data base.

10.3.3 Digital outputs

When a PC program changes the value of a digital output in the data base, the value is written into the bus controller for further transmission via MasterFieldbus to the I/O unit. In the data base one can determine (for each channel) what value an output from the I/O unit will assume if the unit should lose contact with the superordinate system.

10.3.4 Analog outputs

Analog outputs are handled in the same way as digital outputs; see Section 10.3.3 Digital outputs. The process values from the Controller are translated in the I/O unit into current or voltage signals in accordance with the parameters indicated in the data base.

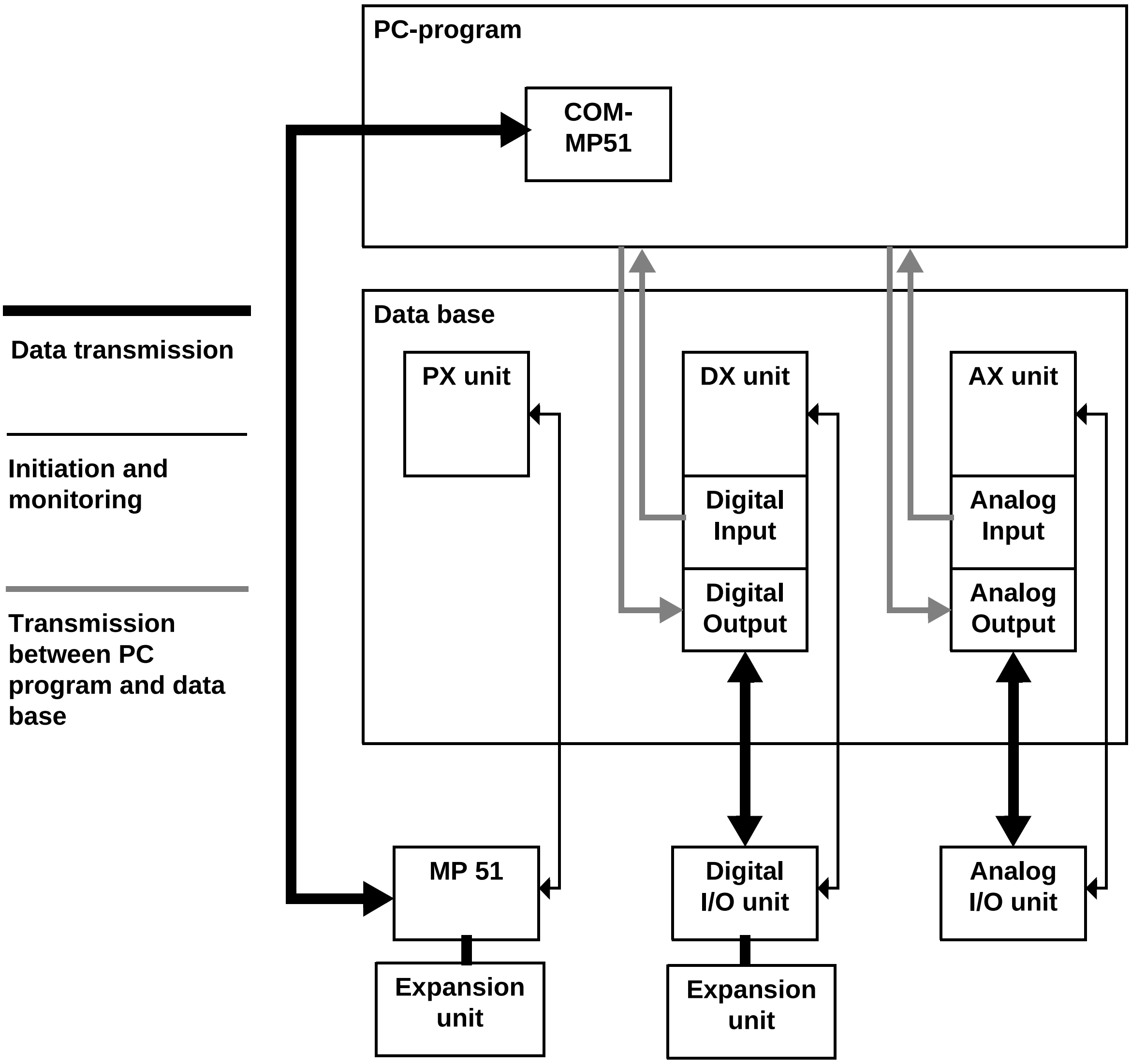
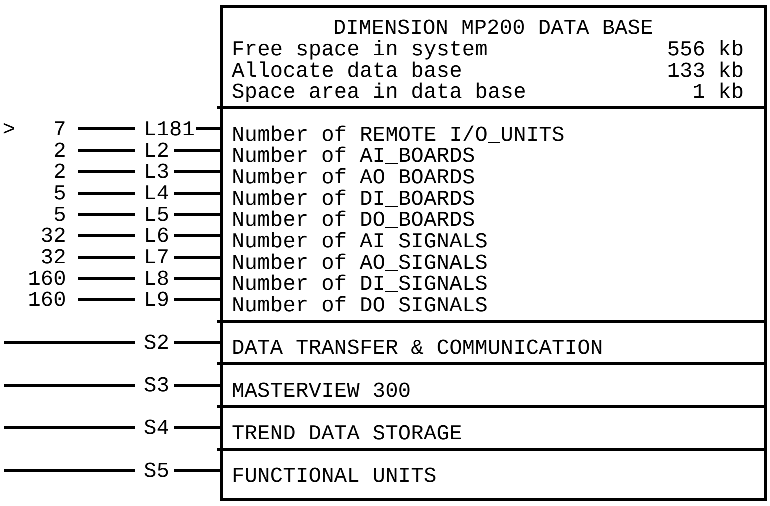


Figure 10-1. Information flow in a system with ABB MasterFieldbus and remote I/O units.

10.4 Dimensioning of the data base

The dimensioning of the data base (command DIMDB) is described in the manual *AMPL Configuration Advant Controller 400 Series*.



```
                                   DIMENSION MP200 DATA BASE
                            Free space in system              556 kb
                            Allocate data base                133 kb
                            Space area in data base             1 kb

>   7 ---- L181-            Number of REMOTE I/O_UNITS
    2 ---- L2               Number of AI_BOARDS
    2 ---- L3               Number of AO_BOARDS
    5 ---- L4               Number of DI_BOARDS
    5 ---- L5               Number of DO_BOARDS
   32 ---- L6               Number of AI_SIGNALS
   32 ---- L7               Number of AO_SIGNALS
  160 ---- L8               Number of DI_SIGNALS
  160 ---- L9               Number of DO_SIGNALS

  ---------- S2             DATA TRANSFER & COMMUNICATION

  ---------- S3             MASTERVIEW 300

  ---------- S4             TREND DATA STORAGE

  ---------- S5             FUNCTIONAL UNITS
```

Figure 10-2. Example of filling of comprehensive data base element for a system with 7 I/O units.

- On ”Number of REMOTE I/O UNITS” input write in the total number of remote I/O units. Count only basic units (including MasterPiece 51), not expansion units.
- On ”Number AI/AO/DI/DO SIGNALS” inputs write in **total** number of channels for each type. Do **not** count MasterPiece 51 channels.

NOTE

Additional entries may exist in newer systems. In Advant Controller 400 Series, the “Number of REMOTE I/O_UNITS is named “Number of MFb UNITS”.

10.5 Configuration of I/O units

10.5.1 Digital basic units DSDX 452 and DSDI 452 plus expansion units

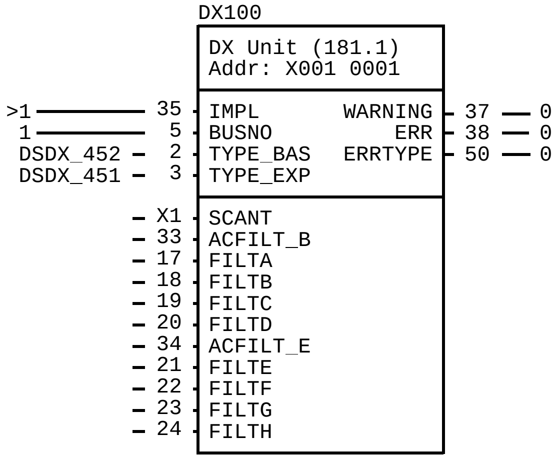


Figure 10-3. Example of filling of data base element DX

The configuration of a data base element DX is done as follows:

1. Create a data base element of the DX type (see Figure 10-3) for each unit with the command CRDB DX. (CRDB = CReate Data Base). The system then produces a DX element with the record designation xyy, where x is the lowest vacant bus number (1-4) and yy is the lowest vacant node number (00-15). The bus number can be changed by selecting another value for the BUSNO input.
2. Indicate ”DSDX_452” or ”DSDI_452” on the TYPE_BAS connection.

   This creates the subordinate channel elements: the Digital Input element with the record designation DXxyy.1 up to DXxyy.20 (DXxyy.32 for DSDI 452) and the Digital Output element with record designations DXxyy.21 - DXxyy.32 (DSDX 452 only).
3. Define the data base element's other inputs as necessary. Change channel element's default value as necessary. See unit data sheet for Digital Input and Digital Output.
4. Define any expansion units by indicating ”DSDX_451” or ”DSDI_451” on the TYPE_EXP connection. Retain ”0” if no expansion units are to be used.

   This creates the subordinate channel elements for the expansion unit: the input element Digital Input with record designations DXxyy.33 up to DXxyy.52 (DXxyy.64 for DSDI 451) and the output element Digital Output with record designations DXxyy.53 up to DXxyy.64 (DSDX 451 only).

10.5.2 Analog basic unit DSAX 452

The configuration of a data base element AX is done as follows:

1. Create a data base element of the AX type (see Figure 10-4) with the command CRDB AX. (CRDB = CReate Data Base). The system then produces an AX element with the record designation xyy, where x is the lowest vacant bus number (1-4) and yy is the lowest vacant node number (00-15). The bus number can be changed by indicating another value on the BUSNO input.
2. Retain ”DSAX_452” on the TYPE_BAS connection.

   This creates the subordinate channel elements: the Analog Input unit with record designations AXxyy.1 - AXxyy1.4 and the Analog Output element with record designations AXxyy.15 - AXxyy.20.
3. Change channel elements' default values. See element data sheets for Analog Input and Analog Output.

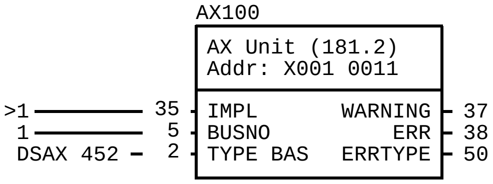


Figure 10-4. Example of filling of data base element AX

10.5.3 MasterPiece 51 (basic unit DSPX 452)

The configuration of a data base element PX is done as follows:

1. Create a data base element of the PX type (see Figure 10-5) with the command CRDB PX. (CRDB = CReate Data Base). The system then produces a PX element with the record designation xyy, where x is the lowest vacant bus number (1-4 and yy is the lowest vacant node number (00-15). The bus number can be changed by indicating another value on the BUSNO input.
2. Retain ”DSPX_452” on the TYPE_BAS connection.

   No subordinate channel elements are created, since all communication is handled by a PC element.
3. Define any expansion units by indicating ”DSDX 451” or ”DSDI 451” on the TYPE EXP connection Retain ”0” if no expansion unit is to be used.

   No subordinate channel element is created for the expansion unit, since all communication is handled by a PC element.

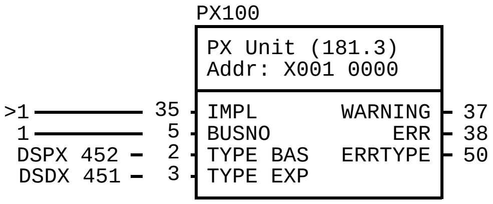


Figure 10-5. Example of filling of data base element PX

10.6 Supervision of MasterFieldbus Units

This section covers supervision of MasterFieldbus units and explains the ERRTYPE in AX, DX, PX, and other database elements.

Supervision of the MasterFieldbus is done mainly by the Status Display and the status messages in the Operator Station, or the STATUS element in the Process Station. For start-up and troubleshooting especially, the ERRTYPE information is provided in the database elements. In the element displayed on the Configuration Tool the most significant error is given in English text.

The ERRTYPE information can also be decoded for use in AMPL programming. The major use for this is to make available indications of failing redundancy or redundant MasterFieldbus (Channel A or Channel B failing), when the Operator Station is not used or not sufficiently available.

Decoding is done using the PC element CONV-IB (I,4,15). Cyclicity 1 second or 2 seconds is suggested. S set to D=1, L and R set to D=0 and I is connected to the ERRTYPE of the I/O unit element to be supervised.

The significance of the outputs is given in the following table.

Table 10-1. Significance of the Outputs

Description	Output	DX	AX	PX
Not initiated (wrong BUSNO, IMPL = 0)	O14	X	X	X
Bus Controller Error (Bus Controller missing)	SIGN	X	X	X
Communication Error (No unit answer)	O15	X	X	X
TYPE_BAS mismatch (with I/O unit)	O2	X	X	X
Hardware Error (ADC reference channel)	O7		X	
Other Error (bad init)	O8	X	X	X
TYPE_EXP Fail (Exp. unit mismatch)	O1	X		X
Transducer Power (on main I/O unit - fuse)	O5	X	X	X
Expansion Transducer Power (on expansion I/O unit - fuse)	O4	X		X
Error Channel A (Cable redundancy)	O12	X	X	X
Error Channel B (Cable redundancy)	O13	X	X	X

The outputs are normally set to 1 (one). Error is indicated with 0 (zero). However, there is a risc that errors of lower significance may be irrelevantly indicated while more significant errors are indicated or outputs may be unstable during start-up. Thus, do not indicate failure on Channel A or Channel B unless outputs O14 and SIGN is set to 1 (one).

Output O11 set to 0 (zero) indicates that the Bus Controller is initiated for redundant bus cables and does not indicate an error.

Chapter 11 Start Up of S400 I/O Units and MasterPiece 51

11.1 Preparations

The voltage to all of the remote I/O units must be shut off. It is assumed that the ABB MasterFieldbus has been installed correctly in accordance with the instructions in Part A. Unless otherwise indicated, the instructions which follow apply to both the remote I/O units and MasterPiece 51. During start-up and troubleshooting the simulation unit 5716 0001-VK can be of great help. The unit is inserted in a jack for digital input signals in the same manner as a normal detachable terminal part.

1. Make sure that the unit/units are correctly installed as described in Chapter 9 Installation of S400 I/O Units.
2. Make sure that all signal conductors are properly screwed to the proper terminals.
3. Check the grounding of the units (see Section 3.5 Grounding of SDB) and any cable shielding (see Section 9.6 Cable installation).

11.2 Setting the address and the communication speed

When data base elements are created for the various I/O units the system indicates an address for each unit (see Section 10.5 Configuration of I/O units). This address consists of three numbers, the first of which indicates the bus's number and the other two of which indicate the node's number. The same address must be set on the actual basic unit by means of a switch group (Figure 11-1). The locations of these groups on the various basic units are indicated in Chapter 12 S400 I/O Units (except MasterPiece 51). Switch #1 on the extreme left is used to set the communication speed. This should be the same as the speed set on the bus controller. Switches 2, 3 and 4 are used to select the bus number, while switches 5, 6, 7 and 8 are used to select the node number. Note that the unit must be turned off and then turned back on again in order for changes in the switch positions to be registered.

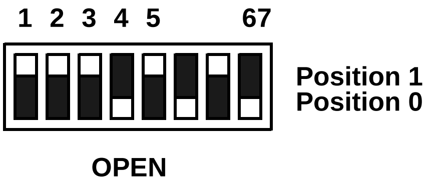


Figure 11-1. Switch group of setting communication speed and address, set here for 2 Mbit/s, bus #1 and node #5.

Table 11-1. Setting the Communication Speed

Communication Speed	Switch # 1
375 kbit/s	1
2 Mbit/s	0

Table 11-2. Setting the Bus Number

Bus Number	Switch number		
	2	3	4
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0

Table 11-3. Setting the Node Number

Node Number	**Switch number**			
	5	**6**	**7**	**8**
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

11.3 Checking transducers and actuators

(For checking transducers and actuators connected to MasterPiece 51 refer to handbook *ABB MasterPiece 51 User’s Manual*).

The basic units and any expansion units must be supplied with voltage. The process to be controlled must be turned off or set in such a way that no dangerous situations can occur when the outputs are actuated.

11.3.1 Checking digital inputs and outputs

Digital inputs to an I/O unit can be checked in the following manner:

1. Actuate the transducer in question or use the simulation unit directly on the input.
2. Check to make sure that the indicator LED on the I/O unit for the input in question lights.

I/O units' connections with the Process Station can be checked as follows:

1. Display the input element in question on the Configuration Tool's display screen by using the command MDB DX xyy.z (z is the channel number).
2. Give the RESTORE command.
3. Make sure that the value for the indicated channel on the input element is ”1”.
4. Write ”1” on the TESTED connection in order to signify that the input has been checked.

Digital outputs from an I/O unit can be checked as follows:

1. Display the output element in question on the Configuration Tool's display screen using the command MDB DX xyy.z (z is the channel number).
2. Write ”1” on the VALUE connection.
3. Make sure that the indicator LED on the I/O unit for the output in question lights up.
4. Make sure that the actuator is operated properly.
5. Write ”1” on the TESTED connection in order to signify that the output has been checked.

11.3.2 Checking analog inputs and outputs

Analog inputs to an I/O unit can be checked as follows:

1. Actuate the transducer in question.
2. Measure the signal at the I/O unit's input.

Analog I/O unit's connection with the Process Station can be checked as follows:

1. Display the input element in question on the Configuration Tool's display screen using the command MDB AX xyy.z (z is the channel number).
2. Give the RESTORE command.
3. Check to see that the value of the input element's VALUE connection changes in agreement with the transducer in question.
4. Write ”1” on the TESTED connection to signify that the input has been checked.

Analog outputs from an I/O unit can be checked as follows:

1. Display the output element in question on the Configuration tool’s display screen using the command MDB AX xyy.z (z is the channel number).
2. Write an analog value on the VALUE connection.
3. Measure the signal at the I/O unit’s output.
4. Make sure that the actuator is operated correctly.
5. Write ”1” on the TESTED connection in order to signify that the output has been checked.

11.4 Troubleshooting remote I/O units

If the Bus Controller is unable to make contact with a remote unit the corresponding LED on the card will not light. Check communications over the ABB MasterFieldbus as per the instructions in Section 5.3 Troubleshooting Sequence. If no errors are found there, check the following:

- Make sure that the Process Station has been reinitiated after the unit in question was configured in the data base.
- Are there additional units along the same branch that are also malfunctioning? If there are, the problem probably lies in the bus or in the Bus Controller (modem, cables, connections).
- Does the PW LED on the remote unit light up? If not, make sure that the line voltage is on and that the internal power fuses are intact.
- Check the RUN indicator. Compare with the table in Section 8.6 Indicators. If the RUN indicator is out then there is a malfunction in the unit.
- Make sure that the correct address and speed are set on the unit (see Section 11.2 Setting the address and the communication speed and Section 11.3 Checking transducers and actuators). Turn the unit off and then on in order to make sure that the latest setting is registered by the program.
- Check the TP LED. If it is off it means that there is no transducer power supply in the unit. However, this will not cause contact with the Process Station to be broken off.

11.5 Start-up of MasterPiece 51

The start-up of MasterPiece 51 is described in detail in the handbook *ABB MasterPiece 51 User's Manual*, Chapter 4 Start Up of MasterFieldbus.

The local programs in MasterPiece 51 units begin to run when the RUN/STOP switches of the respective units are set to RUN, regardless of whether the Process Station system has started. MasterPiece 51 has an internal monitoring function which emits a signal (F103) if no information is coming in via the MasterFieldbus. This signal can be utilized in the local program, for example, to allow it to idle as long as the Process Station is not in operation. One simple procedure is to enter the following instructions into the program in MasterPiece 51 **last**:

```
..........

..........

LD      F103     Result register receives the value ”1” if there is no
                 communication with the superordinate system.

SET     F1       All Q- and QR-channels are zeroed if the result register has the
                 value ”1”. (Note that the channels can still be actuated, which is
                 why this program sequence must be located last in the program -
                 immediately before the updating of the outputs).

END
```

If one wishes to execute the PC program in MasterPiece 200/1 before communication with MasterPiece 51 has begun, it is possible to use the DEFault function to set the outputs from PC element COM-MP 51.

11.6 System start-up

All of the basic and expansion units in the system must be supplied with power. The local programs in the MasterPiece 51 units should be tested.

Start the Process Station system as usual, following the instructions in the appropriate manual.

Start the MasterPiece 51 by turning the switch on the unit's top to RUN.

From the computers' standpoint it makes no difference which order they are started in.

Chapter 12 S400 I/O Units (except MasterPiece 51)

12.1 DSDX 452: Basic Unit - 20 DI / 12 DO

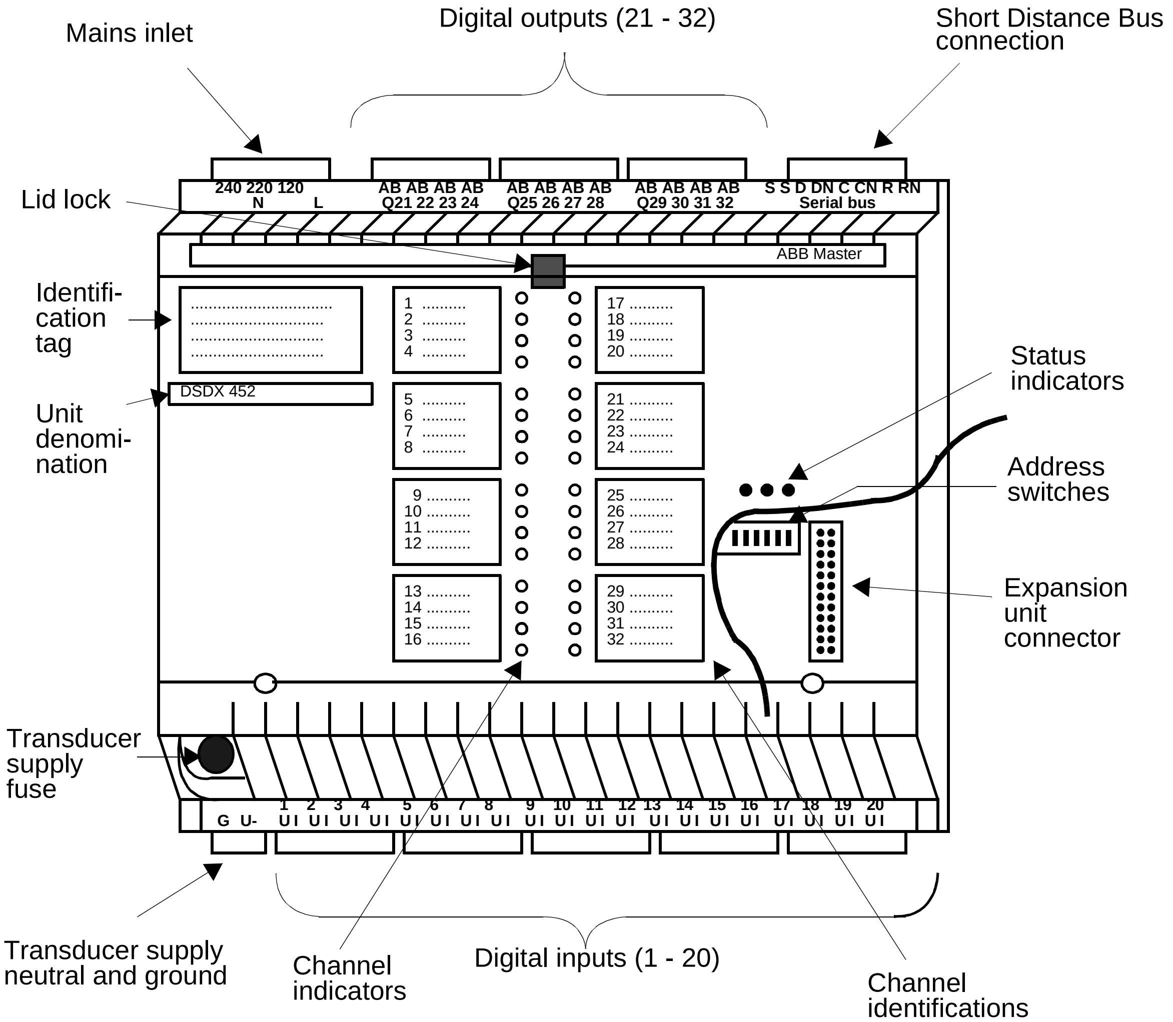


Figure 12-1. DSDX 452; Basic Unit - 20 DI/12 DO

12.2 DSDI 452: Basic Unit - 32 DI

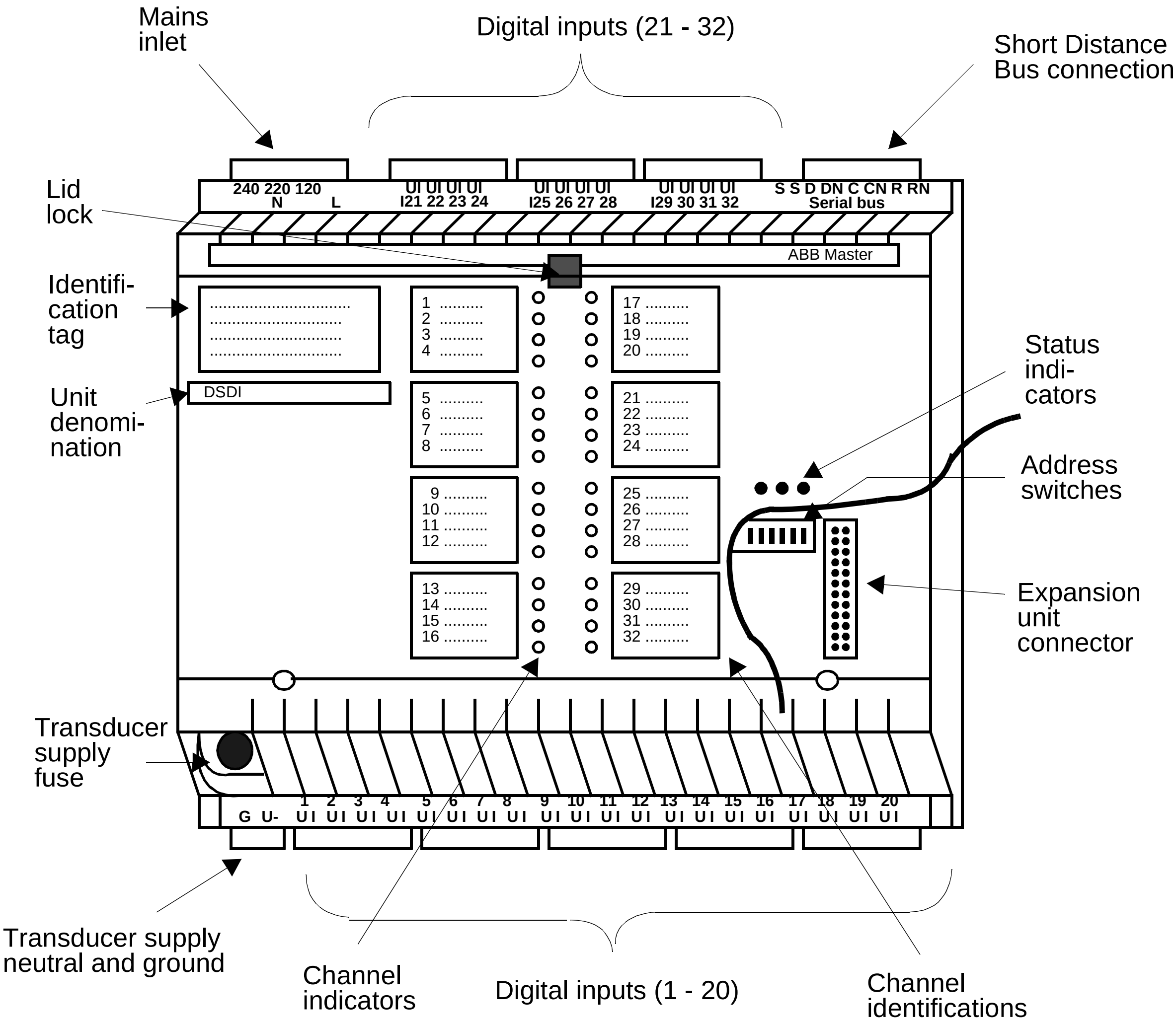


Figure 12-2. DSDI 452; Basic Unit - 32 DI

12.3 DSDX 451: Expansion Unit - 20 DI / 12 DO

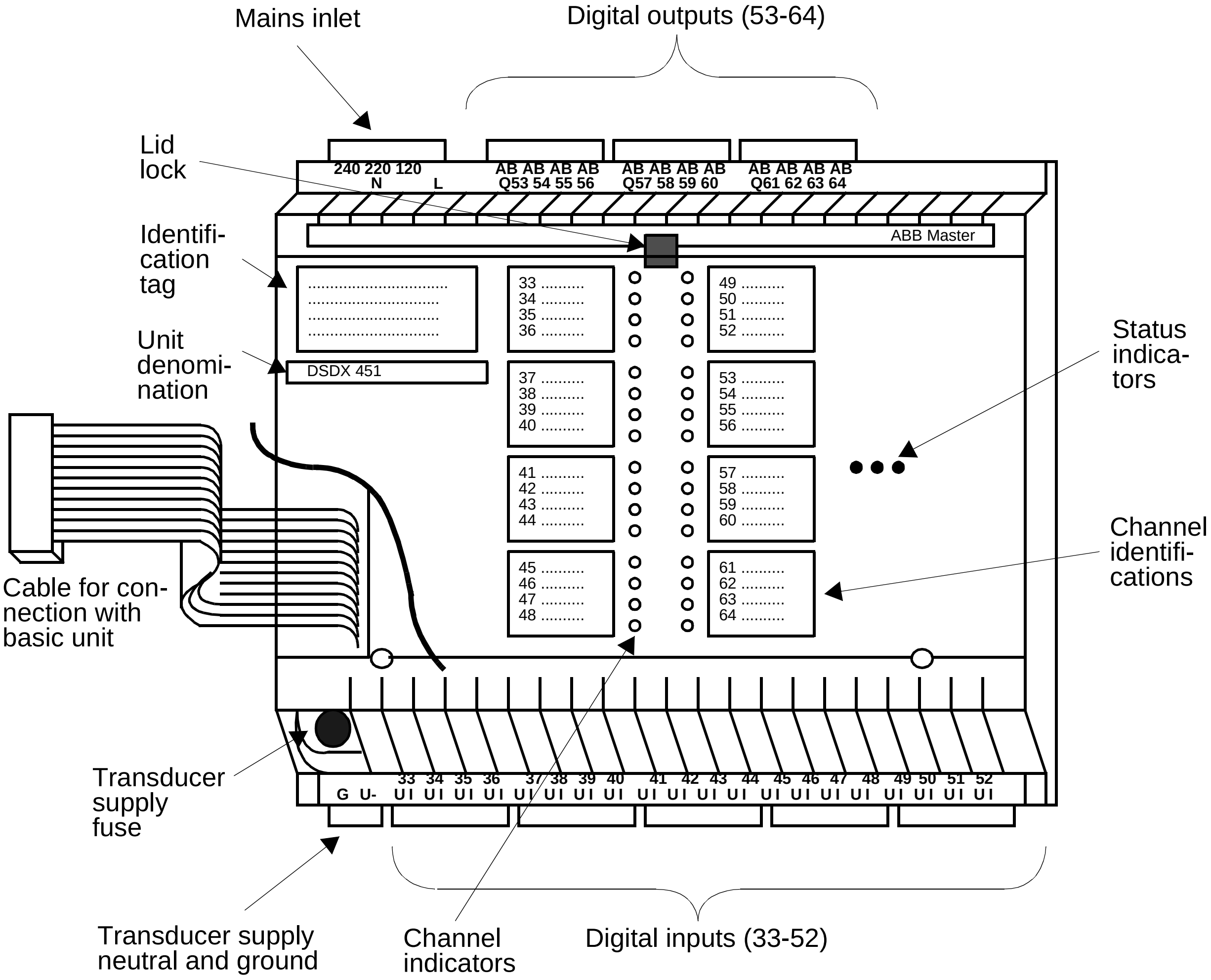


Figure 12-3. DSDX 451; Expansion Unit - 20 DI/12 DO

12.4 DSDI 451: Expansion Unit - 32 DI

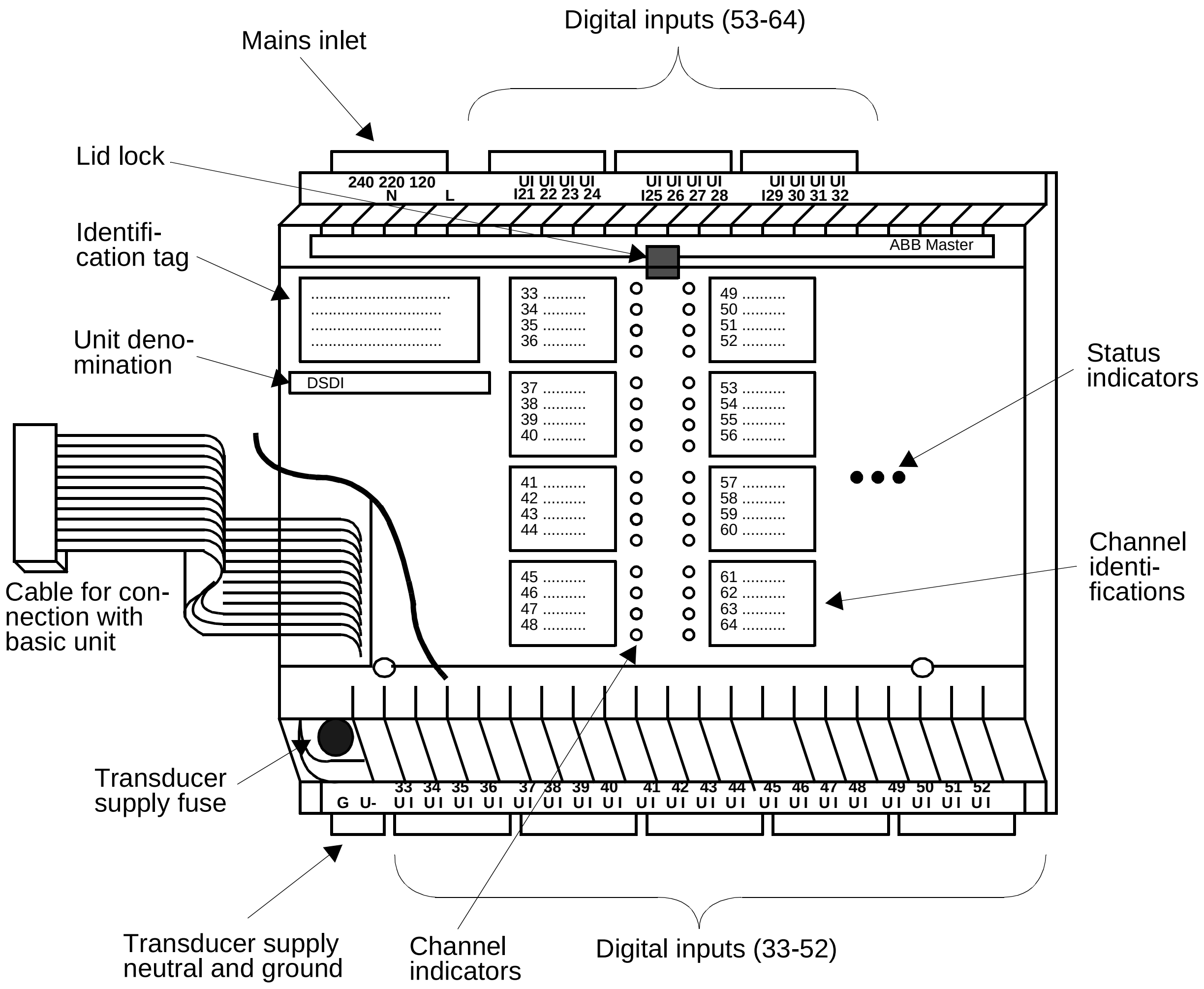


Figure 12-4. DSDI 451; Expansion Unit - 32 DI

12.5 DSAX 452: Basic unit - 14 AI / 6 AO

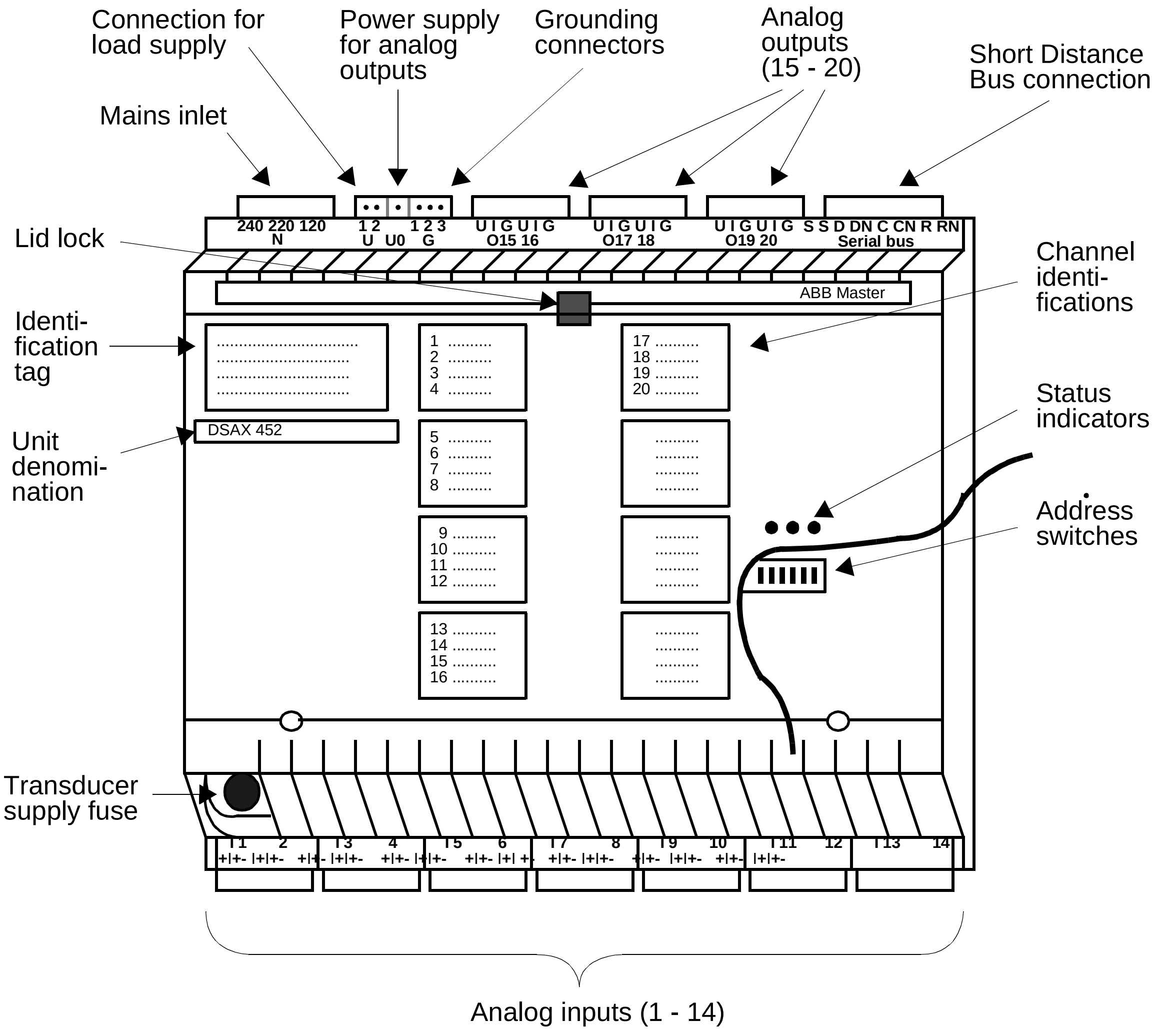


Figure 12-5. DSAX 452; Basic Unit - 14 DI/6 DO

Chapter 13 MasterPiece 51

13.1 General

ABB MasterPiece 51 can function as a remote I/O unit, as an independent process station with its own application program or as a combination of the two.

MasterPiece 51 has 20 digital inputs and 12 digital outputs (expandable to 40 DI/24 DO or 52 DI/12 DO) which are connected directly to the controlled process and are controlled by the local application program in MasterPiece 51. In programming these are called ”I” channels and ”Q” channels. The unit also has 32 digital input channels and 32 digital output channels (”IR” channels and ”QR” channels[1] which are not in direct contact with the process, but rather function as an interface between MasterPiece 200/1 and the program in MasterPiece 51. The physical connection consists of the MasterFieldbus. The signals which reach MasterPiece 51 via these channels can form logical functions with one another or with the normal input signals from the process - the functions are specified by the local application program in MasterPiece 51. The result can be output on MasterPiece 51's digital process outputs or on the digital output channels for transmission to the Process Station via the MasterFieldbus.

Communications between MasterPiece 51 and the Process Station are started and monitored with the help of data base element PX. The actual data transmission does not occur via the data base element, as is the case for the other I/O units, but rather via PC element COM-MP51.

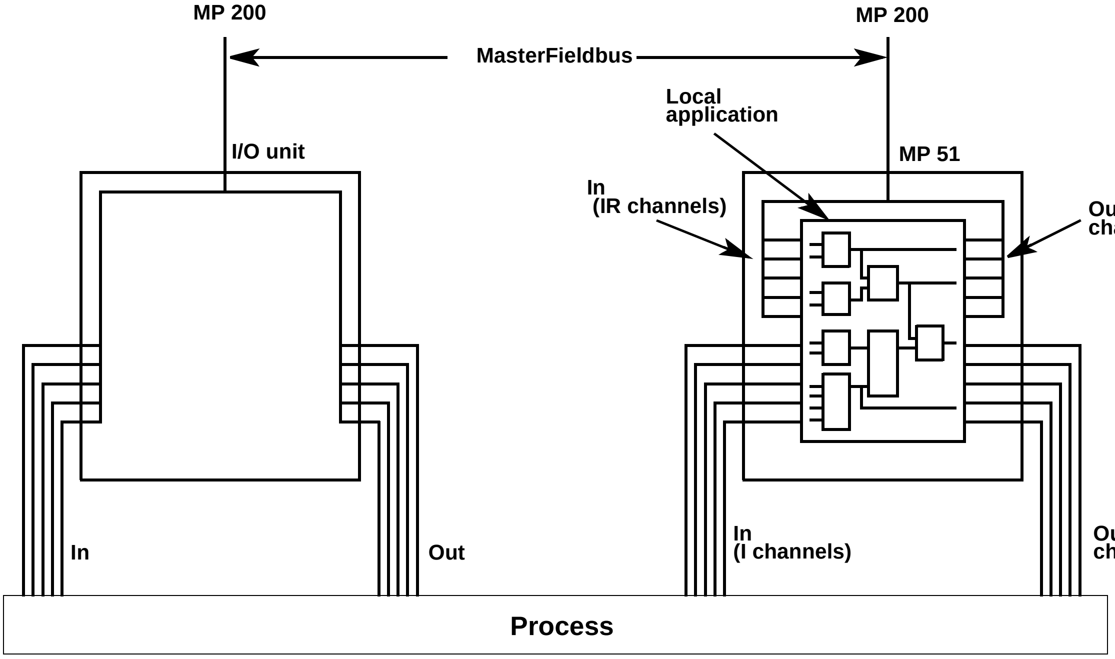


Figure 13-1. Comparison between Function of an I/O Unit and MasterPiece 51

---

[1] I = Input; Q = Output; R = Remote

The use of MasterPiece 51 as an independent process station, its programming and the creation of local application programs are described in the handbook *ABB MasterPiece 51 - User's Guide.* This section concerns the use of MasterPiece 51 as a remote unit on the MasterFieldbus.

13.2 PC Element COM-MP51

While the Process Station programmer's interface with both the remote I/O units and the local inputs and outputs consists of data base channels, the interface with MasterPiece 51 consists of PC element COM-MP 51. The MasterPiece 51 IR and QR channels are mirrored in corresponding PC element inputs and outputs. In order to connect a signal in the PC program to the local application program in MasterPiece 51 one connects it to the IR input on the PC element. The application program in MasterPiece 51 can then read the corresponding IR channel and utilize the signal. The MasterPiece 51 program can in turn output a signal on a QR channel which is mirrored by corresponding QR outputs from the PC element, so that the signal can be utilized in the PC program.

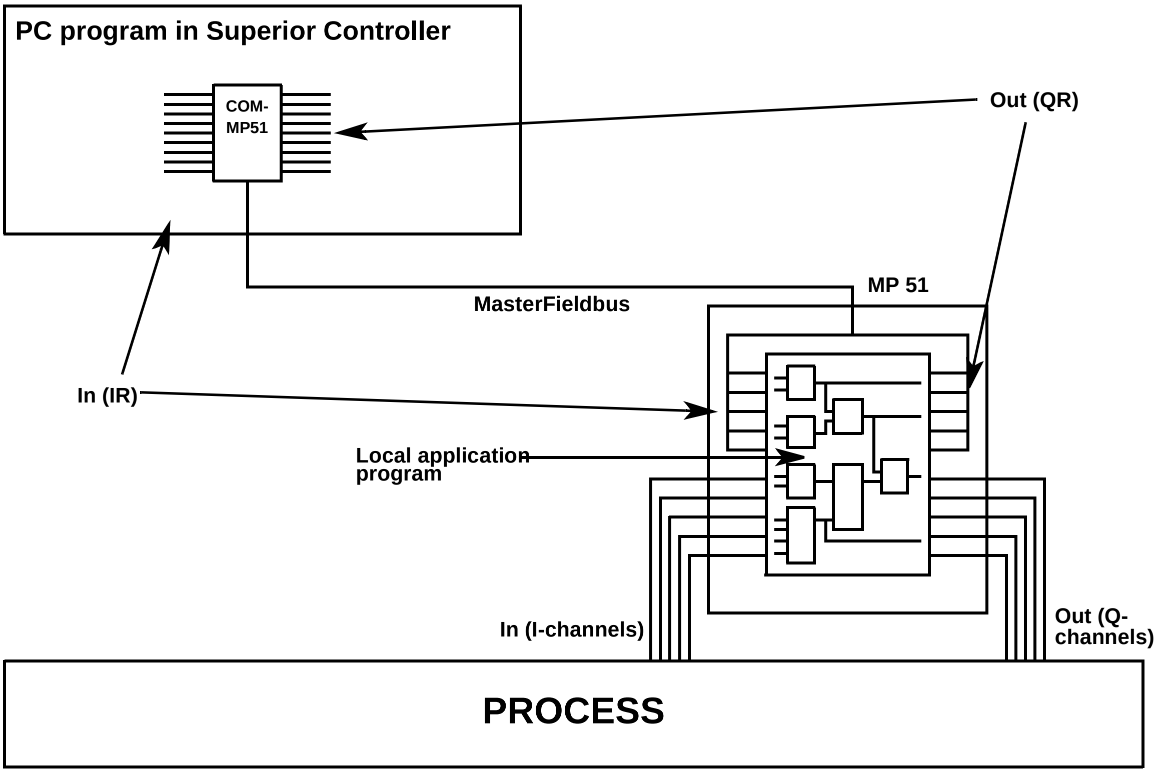


Figure 13-2. PC Unit COM-MP 51 as PC Programmer's Interface with MasterPiece 51

13.2.1 Call

The PC element has the call name ”COM-MP 51 (C1, C2, C3)” where the parameters signify the following:

C1	Number of inputs (IR) from PC program to MasterPiece 51. Allowable value is 0-32.
C2	Number of outputs (QR) from MasterPiece 51 to PC program. Allowable value is 0-32.
C3	Indicates whether or not PC element will have DEFAULT function (see point 13.2.5). Allowable value is 0-1 where ”1” indicates that the element **will** have a DEFAULT function.

Normally **one** COM-MP 51 is used for each MasterPiece 51 unit, but in three instances it may be suitable to use more:

- when different PC programs use values from the *same MasterPiece 51.*
- when fresh values from MasterPiece 51 are needed at a point in the program far from the first input COM-MP 51 element.
- when more rapid execution is required: the input data is obtained from MasterPiece 51 via a PC element and the result is sent back via another PC element which is executed later in the same program cycle.

It is permissible to use several COM-MP 51 elements for the same unit, but the following points must be observed:

- if several COM-MP 51 elements have C1≠0 (i.e., are able to **send** data to the same MasterPiece 51) it must not be possible for them to execute simultaneously. They must wait in different steps in a sequence or in separate MASTER-, CONTRM- or BLOCK modules whose ON-inputs are controlled appropriately.
- it does not suffice to set REMOTE to ”0”.)

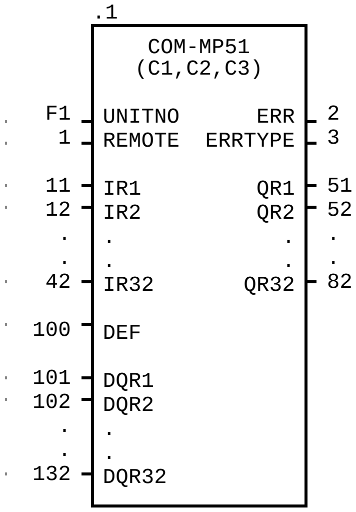


Figure 13-3. PC Element COM-MP51

13.2.2 Connections

Table 13-1. Connections to PC Element COM-MP51

No	Name	Type	Use
F1	UNITNO	II	Indicates which MasterPiece 51 unit and PX element the PC element belongs to. The first digit indicates the bus number, the others the unit number. For example, UNITNO will have the value 103 for PX103.
1	REMOTE	IB	1: ”REMOTE” Normal setting when MasterPiece 51 functions as a remote unit. MasterPiece 51 is remote-controlled assuming that communications are functioning. F103=0 0: ”LOCAL” MasterPiece 51 is in local operation and is not receiving values via the MasterFieldbus. However, the Process Station can read QR outputs from MP 51. F 103 = 1
2	ERR	OB	Indicates error in initiating or readout. The QR values are not reliable.
3	ERRTYPE	OI	Error code for any errors indicated on output 2. See Table 13-2
11-42	IR1..IR32	IB	Input from PC program to MP 51
51-72	QR1..QR32	OB	Output from MP 51 to PC program
100	DEF	IB	0: ”NORMAL” Normal reading of QR data from MP 51. DEF is normally set to ”0” or else connected to the unit's ERR output. 1: ”DEFAULT”The QR outputs assume the values found at the DQR inputs.
101-132	DQR1..DQR32	IB	Indicates the values which the respective QR outputs will assume if input 100 (DEFAULT) is set to ”1”.

13.2.3 Local /remote-controlled operation

In MasterPiece 51 there is a flag, F103 (Communication stop), which has the value ”0” when the unit is operating under remote control but which is set to ”1” when the unit is in local operation. ”Local operation” means that the IR inputs to MasterPiece 51 are not updated. However, the Process Station continues to read the QR outputs from MasterPiece 51.

The following conditions must be satisfied in order for MasterPiece 51 to be in remote-controlled operation:

- Parameter C1 greater than ”0”.
- Communications initiated (correctly filled data base element of proper type) and functioning.
- REMOTE connection to PC element set to ”1”.
- PC element sending data.

Regardless of the status of the REMOTE connection, MasterPiece 51 begins local operation when it is started. If the above conditions are met the unit will go over to remote-controlled operation after the PC element has been executed for the first time.

If MasterPiece 51 is in remote-controlled operation it will switch to local operation in the following instances:

- If REMOTE is set to ”0”.
- If no PC element is sending data.
- If physical communication via the MasterFieldbus has been cut off for more than 0.2 seconds.
- If the command EBM (Enable Build Mode) or BLRS (BLock and ReSet) is carried out for the element.
- If the RESET input on a superordinate structural element goes to ”1”.

NOTE

MasterPiece 51 **cannot** switch over to remote-controlled operation in the following instances:

- the element is located in an execution element which is not active.
- τhe command BLPC (BLock PC) is carried out for the element.

If the PC element stops executing because it has been blocked by the BL PC command or because the executing element to which it belongs in this instance is inactive, then MasterPiece 51 will remain in remote-controlled operation and the QR outputs' values will remain constant until the PC element begins to execute once again.

Note that the indicator light for the relevant channel on the Bus Controller glows even if the PC element is not sending data - it indicates only that communications are functional.

13.2.4 RESET execution

A RESET execution entails the following:

- ERR output is set to ”1”
- ERRTYPE output is set to 17
- F103 in MasterPiece 51 is set to ”1” (which means that MasterPiece 51 switches over to local operation)
- All QR outputs are frozen

The PC element performs a RESET execution if:

- The RESET input on a superordinate structural element changes to ”1”
- An EBM or BLRS command is given for the PC program containing the element.

13.2.5 DEFAULT function

If parameter C3 is set to ”1” when the element is called, both input DEF and inputs DQR1 - DQR32 are obtained. When DEF = ”1” the reading of the values from MasterPiece 51 stops and the QR outputs are set to the values indicated on the corresponding DQR inputs. The DEF input may be set to ”1” in special cases where one wishes to simulate output signals from the PC element, for example, during testing. It is also possible to connect the PC element's ERR output to the DEF input in order to immediately obtain a predetermined output signal combination in error situations.

13.2.6 Error codes

The value of the PC element's ERRTYPE output indicates any errors in MasterPiece 51 in communications with the MasterPiece 51. If more than one error is present, the error with the highest priority is indicated, i.e., the error listed highest in the table. Only those errors which yield ERR = 1 cause the execution of the element to be stopped.

Table 13-2. Error Codes for COM-MP 51's ERRTYPE Output.

Error Code	ERR=1	Error
100	X	Internal data base error
1	X	Data base unit indicated by parameter UNITNO on PC element missing
2	X	Data base unit indicated by parameter UNITNO on PC element not PX-TYPE
3	X	Data base element not accepted. Can be because parameter IMPL = 0, or because bus number is erroneous
4	X	The Bus controller is either faulty or missing
5	X	MasterPiece 51 missing on bus (communications error)
6	X	Initiation underway. If indication continues then a system error is present
7	X	Connected basic unit is not MasterPiece 51
8		Wrong type of expansion unit connected
9		Malfunction of basic unit's transducer power supply
10		Malfunction of expansion unit's transducer power supply
11	X	No local application program running in MasterPiece 51
12		Running of program in MasterPiece 51 stopped at a breakpoint
13		MasterPiece 51 is in local operation and is receiving no information from the Process Station
14		Some of MasterPiece 51's I or Q channels have been forcibly set
15		Some of MasterPiece 51's IR or QR channels have been forcibly set
16		Low battery voltage in MasterPiece 51, or battery is missing
17	X	RESET execution, QR outputs frozen, unit not being executed
18		PC element's QR outputs have assumed DEFAULT values
00	-	OK

13.3 Programming with the Configuration Tool

The local program in MasterPiece 51 can be input from the portable MasterAid 51 programming aid which is described in the handbook *ABB MasterPiece 51 User’s Manual*. When the MasterPiece 51 is used as a remote unit connected to the Process Station it can also be programmed from the Configuration Tool, via the Process Station, with the command PGPLC (PLC ProGramming). Note that only one Tool may be used with the MasterPiece 51 at a time. The the Configuration Tool may come into contact with the MasterPiece 51 assuming that the MA 51 is not **connected** to the MasterPiece 51. The MA 51 can come into contact with the MasterPiece 51 assuming that the MasterPiece 51 is not in the moment being programmed from the Configuration Tool.

Headings and comments may also be input, using the PGPLC command, to make the program listings easier to understand. In the same vein, variable designations can be complemented with symbolic names such as ”`VALVE`”, ”`MOTOR_1`” or ”`CLOCK`”. The local program can be started and stopped from the Configuration Tool, but ***not*** monitored. On the other hand, the program can be monitored from MA 51.

The operation of MasterPiece 51 from the Configuration Tool is menu-controlled. Each menu is laid out as shown in Figure 13-4. The squares correspond to the keys in the numerical keypad. When a key is depressed the function in the corresponding square will be performed. Certain functions initiate a dialog between the Configuration Tool and the user. In the following sections these dialogs are described, with the Configuration Tool's replies underlined. Information which varies from case to case is in angle brackets. <CR> means press *Return* key.

The following functions are common to most menus and will be described only here:

PREVIOUS KEYPAD	Returns to the menu from which one most recently came
HELP	Displays a list of more detailed descriptions of all of the functions which can be performed using the displayed menu.

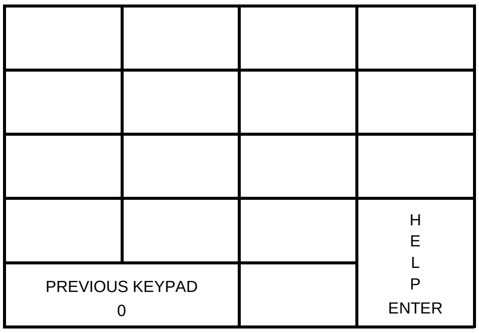


Figure 13-4. Menu’s Appearance (on the numerical keyboard)

The menus are structured as follows:

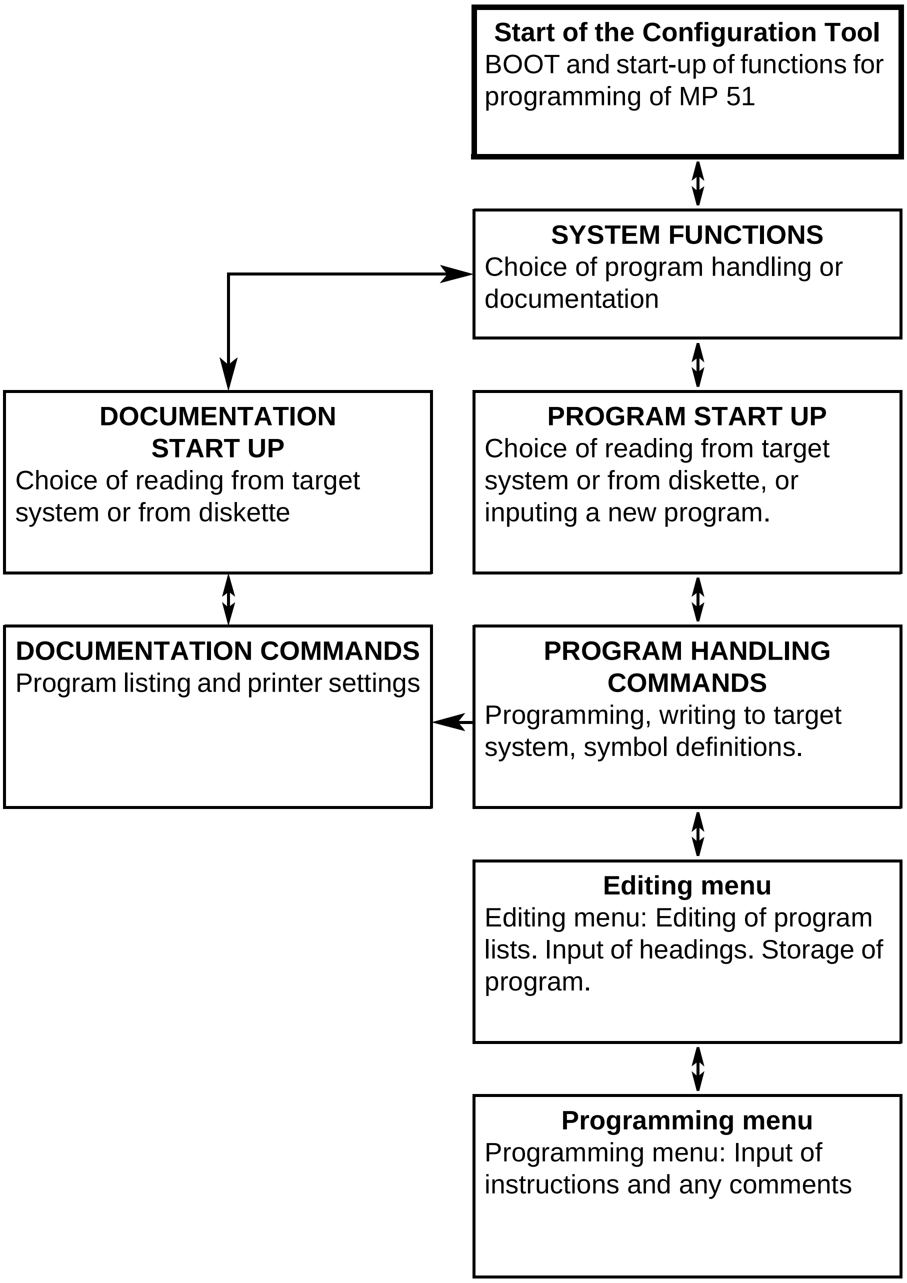

Start of the Configuration Tool
BOOT and start-up of functions for programming of MP 51
SYSTEM FUNCTIONS
Choice of program handling or documentation
DOCUMENTATION START UP
Choice of reading from target system or from diskette
PROGRAM START UP
Choice of reading from target system or from diskette, or inputing a new program.
DOCUMENTATION COMMANDS
Program listing and printer settings
PROGRAM HANDLING COMMANDS
Programming, writing to target system, symbol definitions.
Editing menu
Editing menu: Editing of program lists. Input of headings. Storage of program.
Programming menu
Programming menu: Input of instructions and any comments

Figure 13-5. Menu Structure for Programming MasterPiece 51

13.3.1 BOOT and start-up

You boot and start-up as follows:

- Follow the instructions in User's Manual for the Configuration Tool for BOOT and start-up.
- The following alternatives (sessions) are available:
  - Work locally in the Configuration Tool, without being connected to any system.
  - Work within a system to which the Configuration Tool is directly connected.
  - Work within a system to which the Configuration Tool is connected via a network.
- Start up command to program MasterPiece 51
  - PGPLC <CR>

13.3.2 "System functions" menu

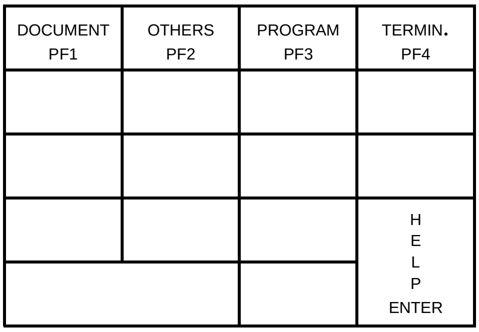


Figure 13-6. The "System Functions" Menu (on the numerical keyboard)

DOCUMENT	To the "Documentation Start Up" menu.
OTHERS	Gives access to the Configuration Tool commands (such as LDIR) without having to leave MasterPiece 51 handling.
PROGRAM	To the "Program Start Up" menu.
TERMINATE	Terminate program.

13.3.3 ”Program Start Up” menu

READ DISK	Reads in a previously-saved MasterPiece 51 program from diskette. If the program is stored in source code or binary format and the volume and segment name are to be specified in a dialogue, See Section 13.3.9 Description of storage format for a description of the storage format. Once the program has been read in the screen will so indicate. One can then continue with ”Program Handling Commands” (see Section 13.3.4 ”Program Handling Commands” menu).
READ TARGET	Reads in a program which is stored in the indicated MasterPiece 51 unit. In the dialog the user must indicate from which MasterPiece 51 unit the program is to be read by indicating the unit's name (for example, PX 103) or its record in the data base (for example, 181.4). It is also possible to read in information which belongs to the program but which is stored on diskette (headings and comments). Once the program has been read in the screen will so indicate. One can then continue with ”Program Handling Commands” (see Section 13.3.4 ”Program Handling Commands” menu).
NEW PROG	To the ”Program Handling Commands” menu. The program memory in the Configuration Tool is erased so that a new program can be input.

<table>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>READ DISK
7</td><td>READ
TARG.</td><td>NEW PROG
9</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td rowspan="2">H
E
L
P
ENTER</td></tr>
<tr><td colspan="2">PREVIOUS KEYPAD
0</td><td></td></tr>
</table>

Figure 13-7. The ”Program Start Up” Menu

13.3.4 ”Program Handling Commands” menu

DOCUMENT To the ”Documentation Commands” menu.

OTHERS Gives access to the Configuration Tool commands (such as LDIR) without having to leave MasterPiece 51 handling.

WRITE TARGETObject code for the program one has built up in the Configuration Tool is written to the indicated MasterPiece 51 unit.

The user specifies the MasterPiece 51 unit to which the program is to be written. The unit's name, such as PX203, or its record designation, such as 181.9, is indicated in the same manner as for READ TARGET. Once the transmission is complete it is possible to start running the program directly in MasterPiece 51.

PROGRAMMINGTo the editing menu.

SYMBOL Makes it possible to ascribe a symbolic name consisting of up to 12 characters to each variable. The program asks which variable the name is to be given to, and one may answer in any of the following ways:

<CR> Gives first variable.

<Letter><CR> Gives first variable which begins with indicated letter. For example, ”I” gives I1.

<Letter><Number>Gives indicated variable.

One the8n enters the symbolic name which is to be associated with the variable and terminates with <CR>. The next variable is then displayed. This variable can be given a name in the same manner, or one can move down the list of variables <CR>, back up the list < <CR> or terminate the name inputting with !<CR>.

<table>
<tr><td>DOCUMENT
PF1</td><td>OTHERS
PF2</td><td></td><td></td></tr>
<tr><td>WRITE
TARG</td><td>PROGRAM.
8</td><td>SYMBOL
9</td><td>PLC FUNCT
.</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td rowspan="2">H
E
L
P
ENTER</td></tr>
<tr><td colspan="2">PREVIOUS KEYPAD
0</td><td></td></tr>
</table>

Figure 13-8. The ”Program Handling Commands” Menu (on the numerical keyboard)

PLC FUNCT

It is now possible to give the following monitor commands to the MasterPiece 51:

- Start running the program in the indicated unit.
- Stop running the program in the indicated unit.
- Copy the program in the indicated unit to the unit's memory module.
- Copy the program from the memory module in the indicated unit to the unit's program memory.

In the dialog the user must specify the MasterPiece 51 unit in the same manner as for the commands READ Target and WRITE Target, i.e., by indicating the unit's name, such as PX302, or its record designation, such as 181.7.

13.3.5 Editing menu

The editing menu is structured in accordance with the same principles as the menus above, but it does not fill the entire screen; instead it occupies the lower section of a split screen. The rest of the screen is used to display the program which is being edited (see Figure 13-9).

PROGRAM	Used to write in a program or change an existing program. One indicates the line on which one wishes to begin, after which one comes to the programming menu (see Section 13.3.6 Programming menu). The lines which are written will be written over any previous text on the same lines.
INSERT	Used to insert new program lines into an existing program. One indicates the line at which one wishes to begin, after which the programming menu appears (see Section 13.3.6 Programming menu). The lines below the point at which one enters the program will be displaced downwards as new lines are written in.

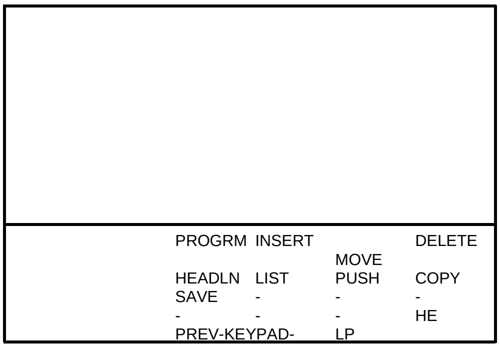


Figure 13-9. The Editing Menu

DELETE	Used to remove one or more lines from an existing program. Dialog: Region to be deleted: In order to delete, for example, line 10, write: 10 <CR>. In order to delete lines 15-25, write: 15>25 <CR>. (”>” can be replaced with ”-”) In order to delete 5 lines starting from line 35, write: 35;5 <CR>. The headings and comments belonging to the indicated lines are also deleted.

MOVE	Used to move one or more lines within an existing program. Dialog: Region to move: In order to move lines 25-120, write: 25>120 <CR>. (”>” can be replaced by ”-”) To start at: In order to move the indicated lines to a region beginning at line 140, write: 140 <CR>. No lines are displaced by such movement. For this reason, the region to which the lines are being moved must be vacant. However, it is possible to move a large block to a region which overlaps the original region, i.e., one can move the program steps in lines 7-11 to lines 10-14.
HEADLINE	Makes it possible to write in or remove headings. A heading is always connected to the program line which immediately follows. A heading can contain a maximum of 4 lines of 40 characters. Dialog: Operation (Write/Delete): In order to write a heading: Write: Write <CR> Write headline before line no: Indicate line number <CR> Write heading text, including any new lines. Terminate with <CR> ! <CR> To remove a heading Write: Delete <CR> Delete headline before line no: Indicate line number <CR> Return to editing menu.

LIST

It is possible to list program codes on the display screen from the editing menu. In order to print out lists on a printer one must go to the ”Documentation Commands” menu.

Dialog:

Region to list:

In order to list, for example, line 10, write:

10 <CR>.

In order to list lines 15-25, write:

15>25 <CR>. (”>” can be replaced by ”-”)

In order to list 5 lines starting from line 35, write:

35;5 <CR>.

In order to list the entire program code, write: <CR>.

PUSH

When a program is loaded from the Configuration Tool to MasterPiece 51 only the program code is transferred. The Tool saves the text portion (headings and comments) on a separate diskette. When the program is read from MasterPiece 51 the program code and the text portion are reunited. One must therefore make sure that the correct diskette is in the Configuration Tool. Complications can arise during the reunion of the program code from the MasterPiece 51 with the text portion from the diskette if the program has been modified (using the portable MasterAid 51 programming aid) while it was in the MasterPiece 51. When one reads the program again displacements may have occurred between the program code and the text portion.

Order can be restored to the program by using the PUSH command. Specified blocks of the program's text portion can be moved up and down in the program code using this command.

Assume that a 20 line region has been altered using the MasterAid 51 as follows:

Five lines have been inserted between original lines 5 and 6.

When we read the program again the headings and comments starting at line 6 and going all the way to the end of the region (line 25) will be located 5 lines too early. This can be adjusted using the PUSH command:

Dialog:

Region to push:

6>25 <CR> (or 6-25<CR>)

Number of lines:

5 <CR>

NOTE

”Region to push” affects **the entire** region within which headings and comments have been displaced in relation to the program code.

COPY

Use to- copy one or more lines within an existing program.

Dialog:

Region to copy:

In order to copy lines 38-53, write:

38>53 <CR>. (or 38-53<CR>)

To start at:

In order to copy indicated lines to a region beginning at line 78, write:

78 <CR>.

No lines are displaced by the copying procedure. For this reason, the region to which the copy is made must be vacant.

SAVE

The program with which the work is performed is stored on a diskette. The program should be saved regularly during the progress of the work. Whether the program is to be stored in source code or binary format and volume and segment names are to be specified in a dialogue with the command. See Section 13.3.9 Description of storage format for a description of the storage format. The volume and segment name need only be specified the first time the program is stored. Only <CR> is needs sub-segmental if the same name is required.

Dialogue:

Save as a source code file? (Y/N)

<Y or nothing indicates source code format

N indicates binary format>><CR>

Volume name= <name, if any specified previously>=

<diskette designation> <CR>

Segment name= <name, if any specified previously>=

<program designation> <CR>

13.3.6 Programming menu

The programming menu is structured according to the same principles as the other menus, but rather than filling the entire screen, it occupies only the lower right-hand corner. The rest of the screen is used to display the program which one wishes to create (see Figure 13-10).

The functions in the menu are all functions which can be used to program the MasterPiece 51. These functions are described in detail in *ABB MasterPiece 51 User s Manual*. Variables and other data are input from the alphanumeric keypad. A choice can be made between indication of the variables' numerical designations (such as C5) or any symbols (such as PULSE COUNTER). Both are indicated in the program lists. Leave a space between the function and the variable. Terminate with <CR> in order to perform the input.

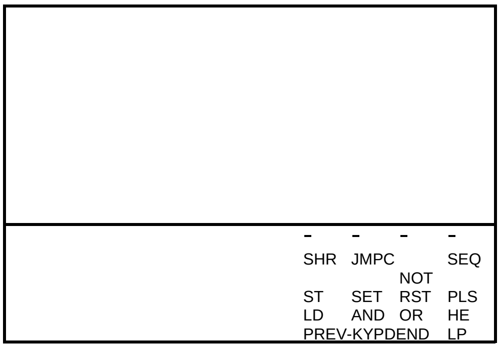


Figure 13-10. The Programming Menu

It is also possible to add comments of up to 30 characters after each instruction. The comment should be introduced with ”(*” and terminated with ”*)” and, for this reason, these character combinations may not be used in the comments.

Here is an example of a completely input instruction with symbols for the variable and a comment:

ST Motor_2 (*Motor starts if I1=1*)

If one comes to the programming menu via the ”PROGRAM” command from the previous menu one can move about within the program and along the lines by using the arrow keys on the Configuration Tool. If one has arrived via the ”INSERT” command then only the right and left arrows may be used.

A cursor on the left edge of the display screen indicates where one is within the program.

13.3.7 ”Documentation Start Up” menu

READ DISK	Reads in a previously-saved MasterPiece 51 program from diskette. Whether the program is store in source code or binary format and volume and segment names are specified in a dialogue. See Section 13.3.9 Description of storage format for a description of the storage format. The screen will indicate when the program has been read in. This message must be acknowledged with <CR>, after which one can continue with ”Documentation Commands” (see Section 13.3.8 ”Documentation Commands” menu).
READ TARGET	Reads in a program which is stored in the indicated MasterPiece 51 unit. In the dialog one must indicate from which MasterPiece 51 unit the program is to be read, by indicating that unit's name (such as PX103) or its record in the data base (such as 181.4). It is also possible to read in information which belongs to the program but which is stored on diskette (headings and comments). The screen will indicate when the program has been read in. This message must be acknowledged with <CR>, after which one can continue with ”Documentation Commands” (see Section 13.3.8 ”Documentation Commands” menu).

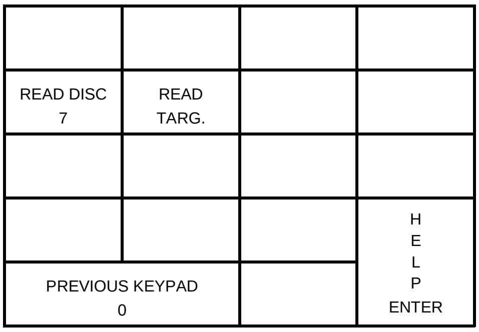


Figure 13-11. The ”Documentation Start Up” Menu

13.3.8 ”Documentation Commands” menu

OTHERS	Gives access to the Configuration Tool’s commands (such as LDIR) without having to leave MasterPiece 51 handling.
INPR	Used to initiate the printer which is connected to the MasterAid 215/220 or Advant Station 100 Engineering Station. In the dialog the user specifies the type of printer and the paper format being used.

	OTHERS PF2		
INPR 7	MDT 8	SEPS 9	
LIST CODE 4	LIST CREF 5	LIST LAB 6	LIST TOT ,
			HELP ENTER
PREVIOUS KEYPAD 0			

Figure 13-12. The Documentation ”Commands” Menu

MDT	Used to define the texts which are printed out in the bottom margin of each document page. In the dialog the program shows a keyword to the text and indicates how many characters the user may write in. Any previous texts are displayed. The user can respond in any of the following ways: Write in a new text + <CR>. Move to the next text with <CR>. Delete the old text without writing in anything new with <CR>. Terminate the input with !<CR>.
SEPS	Used to adjust the page size of the document which is to be printed out. The page’s height and width are set in the dialog with the program. If the page size proposed by the program is correct one need only depress <CR>. Otherwise another value must be indicated. Terminate the input with !<CR>.
LIST CODE	Prints out the program code, including headings and comments.
LIST CREF	Prints out the cross-reference list between the signals and symbols which have been used in the program. The list also indicates where they were used.
LIST LAB	Prints out a cross-reference list between the jump addresses and the jump instructions. The list indicates the addresses’ numerical identities and where they are located.
LIST TOT	Prints out the program code, a cross-reference list between signals and symbols and a cross-reference list between jump addresses and jump instructions.

13.3.9 Description of storage format

The binary storage form can be used in the first place to save working copies as it is handled faster then the source code format. The binary storage format is however very sensitive to changes in the command PGPLC and MasterPiece 51. This means that it is not suitable as a storage format to move program between different versions of the command and MasterPiece 51.

The storage form source code is primarily intended for backup copies of MasterPiece 51 programs and to move programs between different versions of both the command PGPLC and MasterPiece 51. The source code format permits the storage in files on a disc, of solutions to repeating problems. An ordinary text editor can be used to assemble these standard solutions to provide a frame for a new application.

13.3.9.1 Broad description of MasterPiece 51 - Source code

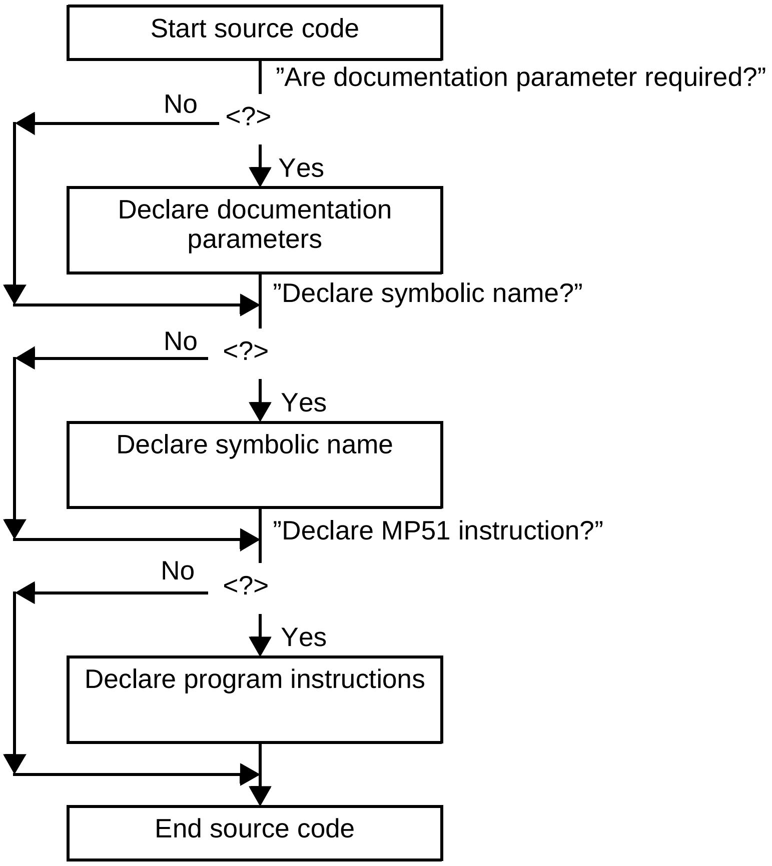

Start source code
”Are documentation parameter required?”
No
<?>
Yes
Declare documentation parameters
”Declare symbolic name?”
No
<?>
Yes
Declare symbolic name
”Declare MP51 instruction?”
No
<?>
Yes
Declare program instructions
End source code

Figure 13-13. Broad Description of MasterPiece 51 - Source Code

13.3.9.2 Syntax description of MasterPiece 51 source code

This type of comment is not stored. As a result, these comments are lost if a source code is read in with READ DISK and then saved with SAVE. The comments can be used to document a complete program or standard solution.

The comments can occur individually on an optional line in the source code. The appearance of these is in accordance with the model used in PC- and DB-source code.

((*code*)

text = optional text (not saved)

Start source code

Indicates that this is a MasterPiece 51-source code.

BEGIN MP51

Documentation parameters

This section is used to specify parameters used in documentation of the program. The lines need not be in any specific order.

INPR <Printer type>,<Paper format>

Printer type = Prism, Microline or Other

Paper format = 3 - 12 with steps of 0.5.

SEPS <Width>, <Height>

Width = number of columns available for writing

Height = number of lines to write on

DESIGN_CH	<Text (25)>
TECH_REF	<Text (25(>
RESP_DEPT	<Text (25)>
DATE	<Text (25)>
L_TEXT2	<Text (37)>
L_TEXT3	<Text (37)>
L_TEXT4	<Text (37)>
R_TEXT1	<Text (27)>
R_TEXT2	<Text (27)>
R_TEXT3	<Text (27)>
R_TEXT4	<Text (27)>
REV_IND	<Text (3)>

LANGUAGE   <Text (2)>

”Text” = Optional text with max the number of characters which is indicated between ().

Symbolic names

Symbolic names are used to allocate more legible names to the variables used in the program.

Program instructions

An MasterPiece 51 program consists of a number of different types of instructions which can be mixed freely.

NAME	Program Name
	Program Name = name of the program in accordance with xxxxxxxxxx/xx. Used to set a name on the MasterPiece 51 program (= line 0). This is normally the first instruction in a MasterPiece 51 program.
HEADLINE	(* <Text> *)
	Text = Optional text of a maximum of 40 characters. Used to document program sections. The program can have up to 40 different sections, each with four HEADLINES, i.e. in the same way as in the interactive handling.
INCRLINE	<Number_of_lines>
	Number_of_lines = number of empty lines to the next instruction. Used to create a space between different program sections, and as a preparator for possible extension of the code.
	<Instruction><Variable> (* <Comments> *)
	Instruction= AND, OR, LD, ST JMPC etc.
	Variable= I1..I20, Q21..Q32 etc..
	Comments= Optional tent of a maximum of 30 characters. This comment is saved with the instruction in the same way as in the interactive handling. A maximum of 400 such comment can be used.

End source code

Indicates end of the source code

END MP51

13.3.9.3 Example of MasterPiece 51 - Source code

```
(*Example of comments not saved.*)
(*Can be used to document the source code file.*)
BEGIN MP51

(*Set up printer parameters*)
INPR        Microline, 8.5
SEPS        90, 92

(*Parameters for the document foot*)
TECH_REF    Sven Svensson
RESP_DEPT   AB Svensson & Svensson
DATE        89-08-27
L_TEXT2     Example of MP51-codes

(*Set symbolic name of variables*)
SYMBOL      I1 = Ventil1
SYMBOL      Q21= Motor1

(*The MP51 program begins here*)
NAME        MittProg/00

HEADLINE    (*Comment describing accent program*)
HEADLINE    (*This comment is saved*)

LD          Ventil1(*Load Ventil1*)
AND         F110
ST          Motor1(*STore Motor1*)

END MP51
```

13.3.9.4 Fault handling

There are extensive tests and conversions of input data when source code files are read from a diskette. Any error encountered i the source code file is presented interactively on the display screen. An error message consists of 2 lines, first the message line and then a line with an explanation of the fault.

Source code line where the error was encountered

ERROR: Line with error message.

Example

A non-existing variable (BILLY) has been specified in the SYMBOL-statement.

```
SYMBOL     KALLE = OLLE
ERROR:     Non-existing variable
```

Example

An existing variable (I!) is used or an instruction which cannot handle this variable.

```
ST              I1    (*STore in input variable 1*)
ERROR: Variable not allowed for this instruction.
```

13.3.9.5 Limitations

MP51 is a reserved word which means that it cannot be used as a symbolic name or as a name on a label.

The source code handling does not retain the internal MasterPiece 51 communication and printer parameters which are handled by the binary format. These parameters are stored in the MasterPiece 51 program code.

Variables which in PGPLC are shown as ”?” are not saved between a SAVE and READ DISK, which can be handled by the binary format. This type of variable can be obtained when a program is read from MasterPiece 51 with READ TARGET which is programmed for an expansion board and the board, for some reason is withdrawn from service. The source code handling cannot manage this because the exact instruction sequence, MasterPiece 51’s assembler code, is lost when a translation is performed to source code. These is no information as to how a ”?” is to be translated back from source code to internal format when the source code file is read in again. This then activate an error message when such a source code file is read in.

The binary storage format is identical with the internal format in the command and no information is lost when data is saved on a disk.

Chapter 14 Technical Data of S400 I/O Units

14.1 Remote I/O Units

Table 14-1. DSDX 452

DSDX 452	**Digital basic unit**
Number of inputs	20, Digital, 24 V d.c.
Number of outputs	12, Digital, relay
Communication	MasterFieldbus SDB
Monitoring	Power loss, self-test when started, monitoring of communications
Indicators	Operation, channel indicator, power supply, transducer power supply
Expandable	With DSDX 451 or DSDI 451

Table 14-2. DSDI 452

DSDI 452	**Digital basic unit**
Number of inputs	32, Digital, 24 V d.c.
Number of outputs	0
Communication	MasterFieldbus SDB
Monitoring	Power loss, self-test when started, monitoring of communications
Indicators	Operation, channel indicator, power supply, transducer power supply
Expandable	With DSDX 451 or DSDI 451

Table 14-3. DSDX 451

DSDX 451	**Digital expansion unit**
Number of inputs	20, Digital, 24 V d.c.
Number of outputs	12, Digital, relay

Table 14-3. DSDX 451

DSDX 451	**Digital expansion unit**
Communication	Only with the basic unit to which the expansion unit is connected
Monitoring	Monitored by basic unit
Indicators	Operation, channel indicator, power supply, transducer power supply
Expandable	No

Table 14-4. DSDI 452

DSDI 451	**Digital expansion unit**
Number of inputs	32, Digital, 24 V d.c.
Number of outputs	0
Communication	Only with the basic unit to which the expansion unit is connected
Monitoring	Monitored by basic unit
Indicators	Operation, channel, indicator, power supply, transducer power supply
Expandable	No

Table 14-5. DSDX 454

DSDX 454	**Digital basic unit**
Number of inputs	20, digital, 48 V d.c.
Number of outputs	12, digital, relay
Communication	MasterFieldbus SDB
Monitoring	Power loss, self-test when started, monitoring of communication
Indicators	Operation, channel, indicator, power supply, transducer power supply
Expandable	With DSDX 453 or DSDI 453

Table 14-6. DSDI 454

DSDI 454	Digital basic unit
Number of inputs	32, digital, 48 V d.c.
Number of outputs	0
Communication	MasterFieldbus SDB
Monitoring	Power loss, self-test when started, monitoring of communication
Indicators	Operation, channel, indicator, power supply, transducer power supply
Expandable	With DSDX 453 or DSDI 453

Table 14-7. DSDX 453

DSDX 453	Digital expansion unit
Number of inputs	20, digital, 48 V d.c.
Number of outputs	12, digital, relay
Communication	Only with the basic unit to which the expansion unit is connected
Monitoring	Monitored by basic unit
Indicators	Operation, channel, indicator, power supply, transducer power supply
Expandable	No

Table 14-8. DSDI 453

DSDI 453	Digital expansion unit
Number of inputs	32, digital, 48 V d.c.
Number of outputs	0
Communication	Only with the basic unit to which the expansion unit is connected
Monitoring	Monitored by basic unit
Indicators	Operation, channel, indicator, power supply, transducer power supply
Expandable	No

Table 14-9. DSAX 452

DSAX 452	**Analog basic unit**	
Number of inputs	14, Analog	Can be jumpered as differential or single and for curren or voltage
Number of outputs	6, Analog	Unipolar. Puts out current and voltage signals
Communication	MasterFieldbus SDB	
Monitoring	Power loss, self-test when started, monitoring of communication	
Indicators	Operation, transducer power supply, A/D converter functioning	
Expandable	No	

Table 14-10. DSDX 452L

DSDX 452L	**Digital basic unit, low signal level outputs**
Number of inputs	20, digital, 24 V d.c.
Number of outputs	12, digital, relay of low level signal type
Communication	MasterFieldbus SDB
Monitoring	Power loss, self-test when started, monitoring of communication
Indicators	Operation, transducer power supply, A/D converter functioning
Expandable	With DSDX 451, DSDX 451L or DSDI 451

Table 14-11. DSDX 451L

DSDX 451L	**Digital expansion unit, low signal level outputs**
Number of inputs	20, digital, 24 V d.c.
Number of outputs	12, digital, relay of low level signal type
Communication	Only with the basic unit, to which the expansion unit is connected
Monitoring	Monitored by basic unit
Indicators	Operation, transducer power supply, A/D converter functioning
Expandable	No

Table 14-12. DSDX 454L

DSDX 454L	**Digital basic unit, low signal level outputs**
Number of inputs	20, digital, 48 V d.c.
Number of outputs	12, digital, relay of low level signal type
Communication	MasterFieldbus SDB
Monitoring	Power loss, self-test when started, monitoring of communication
Indicators	Operation, channel, indicator, power supply, transducer power supply
Expandable	With DSDX 453 or DSDI 453

Table 14-13. DSDX 453L

DSDX 453L	**Digital expansion unit, low signal level outputs**
Number of inputs	20, digital, 48 V d.c.
Number of outputs	12, digital, relay of low level signal type
Communication	Only with the basic unit to which the expansion unit is connected
Monitoring	Monitored by basic unit
Indicators	Operation, channel, indicator, power supply, transducer power supply
Expandable	No

14.2 Connection Units

Table 14-14. Connection units for external signal conditioning

Data	**DSTD W110**	**DSTD W120**	**DSTD W130**
No of channels	8		
Nominal input voltage	24 V a.c., d.c.	110 V d.c., 120 V a.c., d.c.	230 V a.c.
Input volgare range “1” “2”	15-35 V 0 - 5 V	75 - 145 V_{rms} 0 - 20 V_{rms}	165 - 265 V_{rms} 0 - 40 V_{rms}
Inpu t impedance	d.c. = 1.8 kΩ a.c. = 1.8 kΩ	d.c. = 20 kΩ a.c. = 20 kΩ	32 kΩ @ 50 Hz 27 kΩ @ 60 Hz
Filter time	Fixed, 13 msecond, typical		
Intermediate supply	24 V d.c. ±20%		
Power consumption on intermediate supply	8 mA/channel, typical		
Isolation test voltage signal vs signal signal vs ground	2 kV, 50 Hz		
Noise immunity	According to SS 436 1503, class PL3		

14.3 Technical Data for Remote I/O Units

14.3.1 Power supply

Table 14-15. Power Supply

Rated voltage	120 VAC +10, -15 % 220 VAC +10, -15 %, 47 - 63 Hz (see the first NOTE on page 9-4) 240 VAC +10, -15 %, 47 - 63 Hz (see the first NOTE on page 9-4)
Fuse	0,5 A quick-break, in phase conductor (connection ”L”)
Fuse type	5 x 20 mm glass tube. Order # 5672 2011-11
Power consumption	Typical: Basic unit 25 VA Expansion unit 20 VA
Allowable voltage loss	Less than 10 ms at minimum line voltage and maximum load. At nominal line voltage and a typical load, longer periods of voltage loss without interrupted operation can be allowed.

14.3.2 Transducer power supply

Table 14-16. Transducer Power Supply

Voltage	Digital units: Analog units:	20 - 35 V (24 V), 37 - 63 V (48 V) 22 - 32 V
Maximum load	DSDX 45X: DSDI 45X DSAX 452 DSPC 45X	150 mA 250 mA 300 mA + 120 mA for load on analog outputs 150 mA
Fuse	0,5 A fast	
Fuse type	5 x 20 mm glass tube. Order # 5672 2011-11	
Insulation rated voltage	Digital units: Analog units:	60 V Transducer power supply non isolated
Insulation test voltage	500 V, 50 Hz for 1 minute	

14.3.3 Digital inputs

Table 14-17. Digital Inputs

Type	Galvanically isolated with common return		
Line voltage		24 V	48 V
Input impedance	Typical:	3.5k	8k
Input voltage range	"0": "1":	-30 - 5 V 15 - 30 V	-30 - 10 V 34 - 70 V
Transition level ”0” to ”1”	Typical:	10V	20 V
Filter time constant	Determined by hardware: Programmable:	ca 8 msca 8 ms d.c. 0 - 63 ms a.c. 0 - 126 ms	 d.c. 0 - 63 ms a.c. 0 - 126 ms
Insulation rated voltage	60 V		
Insulation test voltage	500 V, 50 Hz for 1 minute		

14.3.4 Digital outputs

Table 14-18. Digital Outputs

Type	Relay, single make contact, galvanically isolated by channel	
Maximum load	3 A continuous	
Breaking capacity	a.c. d.c.	3 A at 250 V and $\cos \phi > 0.4$ 1.2 A at 48 V and L/R < 40 ms
Spark arrester	RC element over-relay contact 100 ohm/22 n	
Maximum voltage across open contact	250 V	
Mechanical life expectancy	2 x 10^{7} operations	

Table 14-18. Digital Outputs

Electrical life expectancy	Resistive load 220 Va.c./1 A, 24 Vd.c./3 A	2 x 10^6 operations at 1 Hz
	Inductive load 220 Va.c./0,35 A cos ϕ = 0.4	2 x 10^6 operations at 0,5 Hz
Recommended minimum load	100 mA at 24 V, or 2.5 VA	
Insulation rated voltage between relay outputs	250 V	
Insulation test voltage	2.5 kV, 50 Hz for 1 minute	
Insulation rated voltage between relay contacts and other electronics	500 V	

14.3.5 Digital outputs, low level signal

Table 14-19. Digital Outputs, Low Lever Signal

Type	Relay, single make contact, galvanically isolated by channel	
Maximum load	max. 200 mA	
Breaking capacity	a.c. d.c.	max. 200 mA or 5 VA at cos ϕ> 0.4 max. 200 mA or 5 VA at L/R < 40 ms
Spark arrester	RC element over-relay contact 100 ohm/22 n	
Maximum voltage across open contact	250 V	
Mechanical life expectancy	2 x 10^7 operations	

Table 14-19. Digital Outputs, Low Lever Signal

Electrical life expectancy	Resistive load 220 Va.c./100 mA, 30 Vd.c./100 mA	2 x 10^6 operations at 1 Hz
	Inductive load 220 Va.c./100 mA cos ϕ = 0.4	2 x 10^6 operations at 0,5 Hz
Recommended minimum load	min. 1 mA or 0.05 VA	
Insulation rated voltage between relay outputs	250 V	
Insulation test voltage	2.5 kV, 50 Hz for 1 minute	
Insulation rated voltage between relay contacts and other electronics	500 V	

14.3.6 Analog inputs

Table 14-20. Analog Inputs

Type	Differential	0 - ±10 V 0 - ±20 mA
Shunt resistance for current signal	100 ohm	
Input impedance	1 Mohm	
Zero point offset	0 V	
Common Mode Voltage (CMV)	Current: Voltage:	±20 V ±12 V
CMV suppression	min 60 dB	
A/D converter	Resolution:	12 bit + sign

14.3.7 Analog outputs

Table 14-21. Analog Outputs

Type	Non isolated unipolar, simultaneous current and voltage output	
Load	Grounded or floating	
Output signals	0 - 10 V (10 mV/increment); 0 - 20 mA (20µA/increment)	RLoad >2000 ohm RLoad <750 ohm (<1000 ohm with external power supply)
External power supply for analog outputs	27 - 30 V	
D/A converter	Resolution	10 bit, binary code
CMV at current output	U_{CMV} = U0 - 20 mA * R_{LOAD} where U0 = 22 V when internally supplied U0 = U_{EXT} when externally supplied	

14.4 Environment for I/O units

Table 14-22. Environment for I/O Units

Ambient temperature	Operating In storage	5 - 55 °C -40 - 70 °C
Temeprature cycling	+25 - +40°C, 6 cycles	
Vibrations	10 - 55 Hz, +0.15 mm, <2 g	
Sensitivity to cable interference	All inputs and outputs, power supply voltages and communications connections as per SS 436 15 03, class PL3	
Sensitivity to ESD (static electricity)	As per SS 436 1522, class PE3 at arbitrary point on enclosure	
Sensitivity to radio-frequency interference	As per SS 436 1523, class PR3	
Type of enclosure	As per IP 20	
Enclosure’s flammability	As per UL94V-0	

14.5 Physical specifications for I/O units

Table 14-23. Physical Specification for I/O Units

Dimensions	237 x 210 x 90 mm (9.3” x 8.3” x 3.5”)
Weight	2.8 kg (6.2 lbs.)

14.6 Order numbers for I/O units

Table 14-24. Order Numbers for I/O Units

DSDX 452	5716 075-P
DSDI 452	5716 075-E
DSDX 451	5716 075-K
DSDI 451	5716 075-A
DSDX 454	5716 075-AT
DSDI 454	5716 075-Y
DSDX 453	5716 075-AN
DSDI 453	5716 075-AC
DSDX 452L	5716 075-U
DSDX 451L	5716 075-AH
DSDX 454L	5716 075-BG
DSDX 453L	5716 075-BL
DSAX 452	5712 289-A
DSTD W120	5716 0001-ZB
DSTD W130	5716 0001-YX
Aluminium profile DSRA 111 (including cable duct)	2166 0559-R

14.7 Dimension drawing

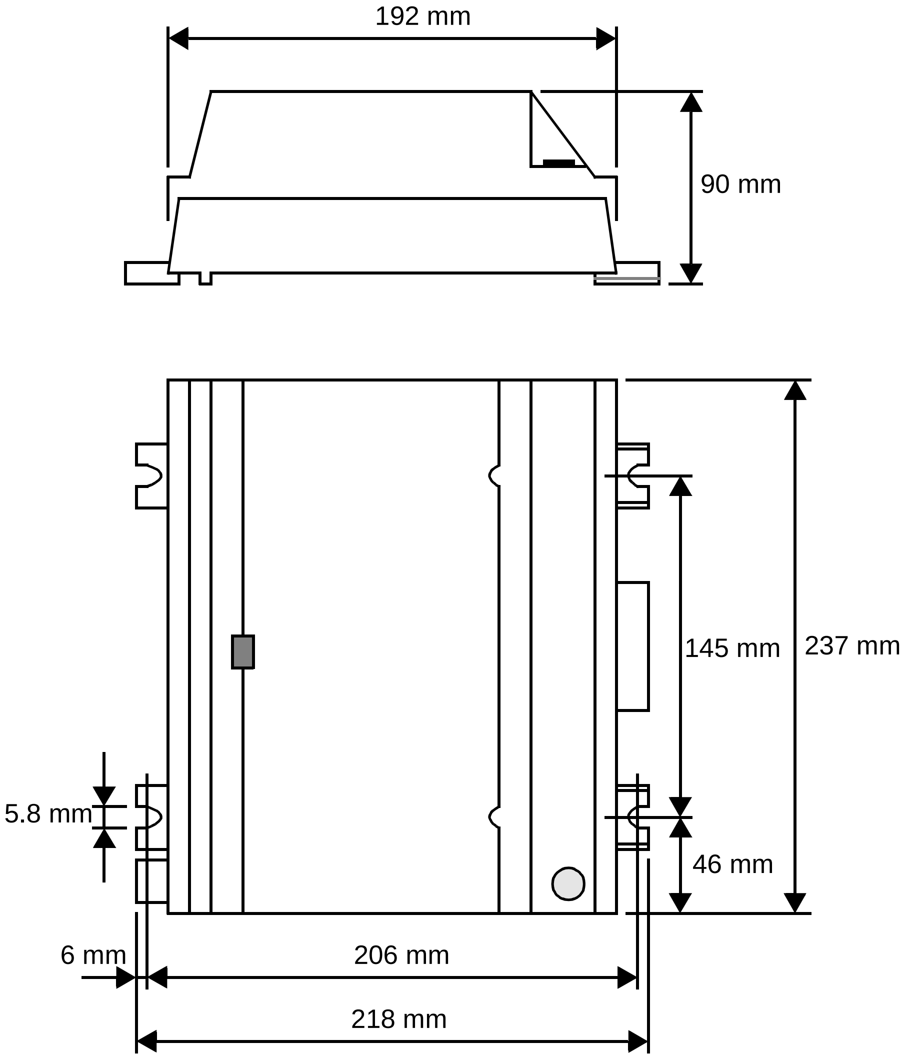


Figure 14-1. Dimension Drawing I/O Unit

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